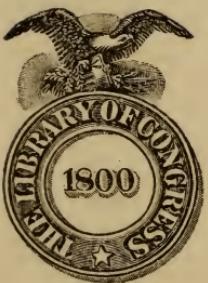


THE FOOD PROBLEM

KELLOGG AND TAYLOR

INTRODUCTION BY HERBERT HOOVER



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THE FOOD PROBLEM



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THE FOOD PROBLEM

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PREFACE

Today the war has entered a phase in which food dominates the economics, strategy and statesmanship, not only of the countries at war but of neutrals as well. The Allies are blockading Germany, and its population is living in an era of food control hitherto undreamed of. The adjacent neutrals are under many restraints and pressures to yield their food to either side and are striving with every resource to protect their vital supplies. The Germans are trying to starve the Allies by sinking their supplies at sea. All are desperately trying to maintain production and reduce consumption. In consequence food problems in balancing vegetable and animal production, in imports, exports, and price controls, in protein, fat and carbohydrate content, are all silhouetted against a background of destruction and tragedy.

The American people as a nation and as individuals are face to face with a great special problem in connection with the whole war problem the solution of which they have undertaken in common with their Allies. A failure to solve this problem with its thousand complexities will certainly involve a

failure to solve the war problem in the only way we and the civilized world must have it solved.

From three years of contact with this problem of food some phases of it perhaps not too familiar to casual students of food regulation are very clear to me. These parts, or special features, are manifest from any examination, however casual, of the endeavours and experience of the countries engaged with the problem.

Any control of prices or distribution is the lesser of evils; a fight against something worse. And any form of control leads into economic reactions that are disconcerting. Another feature is the great rôle which what may be termed the psychology of food supply plays in the situation. However carefully national food supply may be adjusted, from the point of view of the physiology of nutrition and from that of nutritional economics, yet no mere sufficiency of the needed calories and balanced protein, fats and carbohydrate content in the ration will necessarily make it a satisfactory one. People of different kinds, with different traditions and habits of food use, must have, in some measure at least, the particular kinds of food they are used to. They eat more effectively, one may say, the kinds of food they like than the kinds they do not like. Taste and appetite must be consulted and satisfied in some degree.

Another observation that experience, especially in Belgium, brings clearly to my mind is that famine does not occur according to popular ideas. In a country on a food supply below normal necessity all the people do not suffer in the same measure, nor die at the same time. The rich continue to live, despite any rigour in division; the poor get weak, and weaker, and die — of something else than famine. They die of tuberculosis; they die of epidemic disease; they die of whatever it is that finds fertile soil for its fatal growth among a people weakened by mal-nutrition or under-nutrition. The immediate factor in famine is the death rate, from whatever determining cause. This death rate is the measure of the intensity of weakening, and it does not necessarily depend exclusively upon the amount of food that is available.

Another impressive observation brought out by food difficulties is that of our intimate dependence on our domestic animals. We are likely to think first of the supply of cereals, and, indeed, it must be admitted that bread is the very basis of the food supply of a people. But we do not sufficiently realize the equally critical importance of maintenance of our domestic animals in a period of food shortage. We cannot even raise our own young without them. Nor if a nation is robbed of its animals can you keep the death rate of that nation down to normal

by simple importation of animal products. Hence one of the greatest problems in a beleaguered nation is that of the preservation of its herds.

The reduction of the herds has future as well as immediate grave consequences. Europe today is cutting into its capital stock of food animals. That means that, though Europe may be able to increase at once its production of carbohydrate and can supply more animal food at the moment, its after-war problems in protein and fats will be doubled. This situation must have a great reaction upon our own agriculture. Europe will depend on America for years to come for a supply of animal products. The great present stimulation of wheat growing in the United States by guaranteeing minimum prices may yet have some of the characters of a national calamity. Indeed it may be questionable whether we should not in our own country, not only for our own sake but for the sake of supplying our hungry friends of Europe, encourage now the production of animals rather than restrict too largely our encouragement to the production of wheat. We are actually, at the present time, reducing our capital of live stock in proportion to our growth of population. It will be easier for us, just as it will for Europe, to recover lost wheat acreage than the lost herds. We shall find an era after the war when Europe will produce more food grains by virtue of the reduction

of demand for fodder grains — and we shall have less demand for export of food grains and a tremendous demand for animal products. It requires that we begin now to meet this readjustment by laying the foundations for larger herds. One partial substitute for animals may be found by increasing the supply of vegetable fats, and in this lies much of the world's hopes.

All these are only a few phases of the great food problem before us. Professors Kellogg and Taylor have attempted in this book to set out the character and scope of the food problem as it now immediately concerns us, and to indicate the possible and most promising methods of its solution. The United States Food Administration, in close co-operation with all the people of our land, is making a gigantic effort along these lines.

HERBERT HOOVER.

INTRODUCTION

THE INTERNATIONAL PROBLEM

Food is always more or less of a problem in every phase of its production, handling and consumption. It is a problem with every farmer, every transporter and seller, every householder. It is a problem with every town, state and nation. And now, very conspicuously, it is a problem with three great groups of nations, namely, the Allies, the Central Empires and the Neutrals; in a word, it is a great international problem.

If food is a problem in the normal times of peace how much more seriously must it be one in the abnormal times of war; and, above all, of such a world war as the present. In this particular war time, indeed, it is acutely true that food is a great and pressing problem; one of enormous importance, its solution bearing heavily on the whole solution of the war. Only seven years ago M. Bloch, the great Russian banker, wrote: "That is the future of war — not fighting, but famine; not the slaying of men, but the bankruptcy of nations,

and the breaking up of the whole social organization of the nations."

The future of war, as written about by M. Bloch seven years ago, is the present of war today. Not that fighting and the slaying of men are lessened. Only the Napoleonic and the Thirty Years' Wars approach today's war in the terrible losses of human life; and too great a drain on the human life of any one or several of the nations engaged may be the deciding factor in the war's conclusion. But on the whole, and as matters stand today, that part of M. Bloch's prophecy referring to the predominant influence of the food problem in modern war is thoroughly borne out by the facts. Despite the fearful and fatal struggling of an incredible number of men, consuming inconceivable quantities of munitions and using such amazing methods of fighting as were beyond even the fantastic imaginings of the romancers of a decade ago, the national and international phases of the food and general economic problem are the predominant features of the war situation today.

Now we of America are hurling ourselves into the thick of this struggle at exactly the time of both military, economic and food crisis. We are voluntarily taking up part, and, in truth, the greater part, of the burden of solving, if it be soluble — and it must be, and is — this tremendous problem of food

for the Allied world. The food problem of today of our nation, therefore, has as its most conspicuous phase an international character. What is the problem in detail? What are the general conditions of its solution? What are the immediate and particular conditions which especially concern us, and are within our power to affect? And, finally, what are we actually doing to meet our problem?

These circumstances and queries just outlined are those that give special occasion for the writing and publication at this moment of this book.

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PART I

THE PROBLEM AND THE SOLUTION

THE FOOD PROBLEM

CHAPTER I

THE FOOD SITUATION OF THE WESTERN ALLIES AND THE UNITED STATES

WE have joined ourselves, in effect if not in signed compact, with the Allies in a tremendous war task. The men of most of these Allies, the men of England, Scotland, Ireland, France, Italy and Belgium, are fighting; they are not on the farms. But even in peace times these nations looked to us for help in making up the regular annual difference between their food production and their food needs; normally these six countries, taken together, produce but sixty per cent of the grains necessary for their bread. We have always been their greatest and most reliable granary, food store and meat shop. And now, with their production notably lessened, we are almost their only one. The grain of Russia cannot come out. The food of Bulgaria, Roumania and Serbia belongs to the Central Powers. Australia and India are much farther away than ever before, what with submarines and an available supply of ships so small that no ship must travel one

sea-mile farther than absolutely necessary. And the European neutrals, caught between two threatening fires, must divide their little available surplus of meat and dairy products between Germany and England. Of cereals they have, of course, no surplus, but rather an aching void, and, therefore, they, too, must come to us with appeals for the satisfaction of their needs.

America then has the immediate and very great, but not impossible, task in the general division of war labours among the members of the Allied group, of playing a predominant part in insuring a sufficient and regular supply of food for the maintenance of the great field armies of our fighting Allies, and of their no less great armies of working men and women in the war industries, and finally, of their women and children at home. This maintenance of the food supplies of the Western Allies is an absolute necessity, second to no other, for the successful prosecution of the war. Men continuously hungry cannot fight or work; nor will men with starving families continue to fight if they can feed their families by stopping fighting.

Let us then examine a little in detail the food situation of the Allies and the United States, even going to that dangerous extreme, for a writer hoping to be read, of using a few figures. For if we limit ourselves simply to a generalized statement

of the condition and need we cannot point out in any precise terms just what we must do, and how do it, to meet our duty in this matter as a nation and as individuals.

Bread has not infrequently been referred to as the staff of life. But it really is. We of the Relief Commission found it so in feeding Belgium. The loudest call of the people, their principal anxiety, and our first care, all converged on wheat. The German experience, as well as the Belgian one, has shown that a dietetic regimen for a semi-starving people is strong or weak, appeasing or dangerous, in proportion to the bread it contains. If the bread ration is normal, or sufficient, much repression or substitution can be used in the case of the other foods. Thus, considered either from the standpoint of physiology or psychology, seeing to the bread supply is the matter of first importance in the case of peoples living on short rations and getting occasional glimpses into the abyss of starvation.

The cereals, then, should have first consideration in the analysis of the Allied food situation. And all the cereals should be considered, not only those more strictly to be called bread-grains, but also those chiefly used as feed-grains for animals; first, because in a pinch such as the present one, a much larger use than usual of the feed-grains can be made for human consumption by mixing flour made from

them with wheat flour for the bread, and, second, because on the availability of the feed-grains rests the production of meat, animal fats and dairy products which, with sugar, are the other staples of diet.

The annual pre-war production of the cereals, wheat, corn, oats, barley and rye, of the Western Allies (the United Kingdom, France, Belgium and Italy) averaged, taking the three harvests immediately preceding the war as basis, about one and a half billion bushels annually. The annual consumption in the same period of these peoples amounted to nearly two and a quarter billions. But their production this year, because of lessened man-power available for the farms and consequent lessened acreage—in France the acreage is lessened by this and by the actual loss of land to the Germans by one-third—and lessened yield per acre—also partly because of absence of fertilizer—will fall short of the pre-war average by half a million bushels. In France, indeed, the wheat production this year is hardly more than one-half the normal.

The situation as regards the production of meat, animal fats and dairy products is an equally serious one. The herds of the Allies have been seriously cut into since the war began by the lessened production and import (because of shipping shortage) of feed grains and fodder for their support, and by

the necessity of eating into the capital stock to meet the pressing demands for an increased ration of meat and animal fat of millions of men turned from light or sedentary work to the severe physical exertion of the army or the war factories. This reduction of the herds for these causes means a lessened reproduction of animals, with consequent increased lessening of the natural replacement of the herds themselves, creating thus the proverbial vicious circle.

The cattle, sheep and hogs of the Western Allies in 1913 were over a hundred million head. At the beginning of this year they were estimated at about seventy-five million. If the decline in France continues through all this year at the rate followed since the beginning of the war, France will have but twenty-six million head at the end of the year, as compared with thirty-eight million before the war. She has lost 16½ per cent of her cattle, 33 per cent of her sheep and 38 per cent of her swine since the war began. And yet she fights, and gloriously! Is there any doubt that we shall help feed her?

In 1913 the Western Allies imported one and a half billion pounds of animal fat (in terms of fat content). In normal times the dairy fat supply to the Allies arose to a large extent from Russia, now cut off, and from Scandinavia, Holland, Denmark, and Switzerland, the supplies from which are now

going, under German pressure, largely to Germany.

Finally, as to sugar there is also a serious situation to face. Before the war the Western Allies were consuming annually about three million tons and producing considerably less than half of it. France, Italy and Belgium indeed produced a little more than they consumed, but England with an annual consumption of two million tons produced no sugar at all. However, the large balance of production over consumption of Germany and Austria-Hungary, and the smaller one of Russia, France, Italy, Belgium and Holland, sufficed to supply a large part, seventy per cent to be specific, of England's needs. She found the rest in Java, Mauritius, the West Indies (excluding Cuba) and South America to the extent of 16½ per cent; in Cuba and the United States, 8 per cent; and from other scattering sources 5½ per cent.

As a result of the war the European production of sugar has been greatly lessened. For this year, the total crop is estimated, on the basis of the acreage planted, at little more than four million tons. This is less than one-half the crop of 1913-14. The effect of this decrease and of the war situation generally is to cut off almost entirely England's supply from Europe, for the other Allies, France, Belgium and Italy, from being a little more than self-supporting as to sugar, are reduced now

to calling on the outside world for approximately two-thirds of their needs, so radically has their production been cut down.

So much for a swift examination of the actual present situation of our Western European Allies. They need help, and need it badly, and it can come only from us. What then is our own situation? In what position are we to meet the need?

The United States is the greatest food-producing country in the world. We have a larger absolute acreage in crops than any other nation, except possibly China. This acreage (320,000,000 acres) is nearly equal to that of the peace-time acreage of all Europe, excluding Russia (354,150,000 acres). Our total annual production of cereals (bread and feed-grains together) averaged four billion and eight hundred million bushels (average of crops of 1911, 1912 and 1913), while the total peace-time average for all the European countries together, except Russia, is almost exactly the same.

Similarly, figures might be given to show our enormous production of meat and animal products: last year, for example, it was over twenty billions of pounds. But there is no especial significance in these comparisons beyond that of their indication of our interesting magnitude as a food-producing land.

What will be more to the point, and is really

needed, is a comparison of our production with our consumption. However impressive the figures of our output, they do not so much interest the world outside, nor in particular do they carry any comfort to our Allies, if there is not indicated in them the fact that we produce more than we consume. We are a large nation, and a young, vigorous and growing one. Is our appetite and our need of food so great that we eat all we raise? And if we do not, do we leave uneaten enough to make up that deficiency between the imperative needs of our Allies and their production? In the precise answer to these questions we find our problem stated in exact terms. Hence we must again use a few figures.

Whatever our annual production has been, the important thing at the moment is the production of 1917. Fortunately, the crops for this year are now so assured that figures can be given, with close accuracy, of the amount of each kind of cereal we may expect to harvest, or have already harvested this year. (The figures given are the government estimates of September.) Our wheat crop will be about 668,000,000 bushels; our corn crop about 3,248,000; our oats about 1,533,332,000; our barley 204,000,000 and our rye 56,000,000. Roughly, a total of five billion seven hundred million bushels of bread and feed grains. To the great advantage of ourselves and our Allies, this is a crop, taken as

a total, materially larger than our annual average. The excess, however, is composed of feed-grains and not bread-grains. It is in particular our bumper crops of corn and oats this year that run up the total. Our wheat crop is, as a matter of fact, below the average, which is about 800,000,000 bushels.

Our average normal annual consumption of wheat has been 590,304,000; of corn, 2,653,698,000; of oats, 1,148,713,000; of barley, 178,829,000; and of rye, 35,866,000; a total of 4,607,410,000.

Thus, if we continue to consume our cereals as in pre-war time, we should have out of this year's crop a surplus of about eighty million bushels of wheat and one billion bushels of the other cereals taken together.

If we compare now the actual figures (obtained from official sources, and as nearly accurate as may be had) of the probable cereal production of the Western Allies for the year, together with those of their normal consumption, with the figures just quoted, we shall see clearly and exactly the situation.

The production of the Allies this year is closely estimated as follows: Wheat, 393,770,000 bushels; other cereals, 567,016,000 bushels. Their normal consumption is: wheat, 974,485,000; other cereals, 1,239,791,000.

That they may have a normal consumption until

the next harvest, therefore, they must import in the next twelve months a total of about 580,000,000 bushels of wheat and 673,000,000 bushels of other cereals. Of this they can probably obtain from Canada (on basis of the Canadian crop estimates for this year, and the known Canadian normal consumption) about 120,000,000 bushels of wheat and 119,000,000 bushels of other cereals. This leaves them to obtain from us, if possible, about 460,000,000 bushels of wheat and 554,000,000 bushels of other cereals.

Comparing these figures of Allied needs from us with the figures of our probable export surplus on basis of normal consumption, we find ourselves face to face with an easy solution—as far as grain goes; grain ships are another matter—of the situation as regards the “other cereals,” of which we have more than enough to meet the necessity, but with what, at first glance, seems an impossible situation as regards wheat—for which read *bread*, with all of its significance as the very fundamental, the indispensable, basis of the daily ration. How are we—and our Allies—to meet this “impossible situation”?

But the trouble is not with wheat alone. We have already pointed out in general terms the serious situation of the Allies as to the other staples, meat, fats, dairy products and sugar. We do not want to

load this paper with figures and hence shall attempt no such detailed analysis of the situation as regards these staples, as that just undertaken of the cereals. But a few statements will lend some definiteness to the situation.

The cutting down of the meat production of the Allies and their limitation as to import from other sources than American ones, is revealed by the enormous growth of American meat exports, most of which have gone to the Western Allies, since the beginning of the war. Our annual average for the three years just before the war was 493,848,000 pounds; for the year ending June 30, 1916, it was 1,339,193,000. These figures do not include pork products, the exports of which have gone up from a billion pounds a year before the war to a billion and a half pounds for the year ending June 30, 1916.

This demand for meat will not lessen as the war goes on; it will increase. And it will continue for some years after the war, because the reduction of the European herds cannot be made good in a day, nor in a year, after peace comes.

This growing scarcity for native animals and animal products among our Allies, and their dependence on us, is evidenced also by the export figures for dairy products. Our annual average export of butter for the three years before the war

was four and a half million pounds, of cheese three and three-quarter millions, and of condensed milk about eighteen millions. For the year ending June 30, 1917, it was: butter, nearly twenty-seven million pounds; cheese sixty-six million; and condensed milk, nearly two hundred and sixty million pounds!

Finally, another word as to sugar. We have seen that the war has greatly reduced the production of France, Italy and Belgium (England, of course, produces none) and has forced all the Allies away from most of their usual sources of supply and made them turn for help to the United States and to our own usual sources of import. For we have never produced in our own country and possessions (the Philippines, Hawaii and Porto Rico) much more than half the amount consumed by us. We have relied on Cuba to make up our deficiency. Our annual consumption is about four million tons, while the normal total production of the United States and its possessions, Cuba and the other West Indies, in pre-war times was about four and a half million tons. Fortunately there has been, since the beginning of the war, an increase in production in these countries, due to the spur of the increased European demand, of about a million tons. But from the present total the Allies need to draw at least a million and three-quarter tons; perhaps two millions this year. In other words, we and the Allies need

to draw about six million tons from sources producing about five and a half millions; a problem in arithmetic—and eating!

We have outlined one phase, the international one, of the food problem. But there is another. It is the national, or domestic one. This ties up closely, of course, with the wider aspect of the problem. Indeed it is chiefly immediately caused by the attempt at provisioning the Allies, in the uncontrolled manner in which the attempt has been made from the beginning of the war up to now. The more nearly the Allies—and the European neutrals, with their underground pipes into Germany—have come to being fed from America, in the unregulated way so far in vogue, the more acute and larger has grown the domestic problem. It reveals itself most readily, perhaps, by a simple inspection of home prices for home products and a comparison of them as they stand today with them as they stood before the war.

Taking an average of the retail prices for the five years just before the war as a basis, the prices of various familiar foods on July 15, 1917, showed the following increases: cornmeal 115 per cent; flour 110 per cent; potatoes 110 per cent; lard 81½ per cent; bacon 70 per cent; pork chops 66 per cent; round steak 65 per cent; ham 64 per cent; sugar 53 per cent; sirloin steak 51 per cent; rib

roast 47 per cent; hens 41 per cent; milk 27½ per cent; butter 26½ per cent; eggs 24½ per cent.

But the whole story is not told by such a simple comparison. The rate of increase has not been an even one. It was nearly a year after the war began before a permanent tendency for prices to rise asserted itself, and even then the advances for most commodities were rather small. Wheat and flour, and hence bread, however, were notable exceptions. But, by July, 1916, the wholesale prices, as compared with those of 1914, show that almost all the most important commodities cost from fifty to one hundred per cent more than in 1914. Since then the prices have continued to advance, and very notably in the successive months of this year. For example, the retail price of sirloin steak has advanced from 27.6 cents a pound on January 15, 1917, to 32.8 cents on June 15; of bacon from 29.6 cents to 42.5 cents; of ham from 30.6 cents to 39.1 cents; of lard from 21.4 to 28 cents; flour ($\frac{1}{8}$ bbl. bag) from \$1.369 to \$1.973; cornmeal 4.0 to 5.5 cents; potatoes (peck) from 58.7 to 96.0 cents; sugar 8.0 to 9.3 cents.

The price of wheat per bushel was \$1.071 on August 1, 1916, and on August 1, 1917, \$2.289; corn advanced from 79.4 cents to \$1.966; barley from 59.3 cents to \$1.145; rye 83.4 cents to \$1.781; potatoes from 95.4 cents to \$1.708. That is, for

each of these important commodities, with the single exception of white potatoes, the prices have more than doubled within the last year. Where are they going? When are they going to stop?

These terrible present prices of all commodities weigh heavily upon the consumers, especially on those who are on a monthly salary or a day wage; and these constitute the greater proportion of the population. It is true there have been advances in wages. In some cases, several successive advances. But these altogether seldom amount to more than twenty-five per cent, and therefore they are not at all in proportion to the increased cost of foodstuffs. These exaggerated prices have aroused general alarm and created wide-spread belief that serious trouble is likely to confront us in the coming winter unless relief is arranged for.

There may be — and undoubtedly are — several causes contributing to this excessive price increase, but the fundamental cause is certainly the unregulated way in which the extraordinary demand from our Allies and the European neutrals for all essential commodities has been met. One of the contributing causes has been "hoarding," either by the householder buying an unusual amount ahead of his needs, or, and much more seriously, by the large purchases of speculators, and the holding of these purchases against the inevitable increase in

price. These purchases and holdings themselves help to make the increase inevitable. There has been, too, undoubtedly, a certain amount of co-operation among men handling certain commodities to the deliberate end of advancing prices and thus increasing profits.

One part of our domestic problem, then, is that of effecting by one means or another a decrease and stabilization of prices. This presupposes a corrective for hoarding and manipulation; for "profiteering," generally. Another part—which is also a part of the international problem—is the organization of our food production and use so as to create the surplus needed for supplying our Allies, and the regulation, in connection with the Allied governments, of the supplying of this surplus in a manner so as not to force up too dangerously our home prices. Heretofore the Allies have made their purchases in our markets in competition both with each other and with the buyers for our own homes. And, finally, there is another part, also more international than domestic in aspect, which is to create an effective check against an over-supply to neutrals—with their dubious connections. Our food problem is, thus, after all just one big problem, domestic and international at once.

So far it has been all "problem." What of the "solution"?

CHAPTER II

FOOD ADMINISTRATION

THE solution is food conservation; or, better, food administration. For food conservation, as a term, is sometimes used to denote only that part of the general organization, control and economical use of food which is chiefly indicated by the last phrase; that is, the general technic and details of the economic use, preservation, substitution, etc., of food in the household, public eating places and retail shops. The situation involves, however, much more than this food conservation, *sensu strictu*. It demands a food conservation of the broadest sort, involving administrative, educational, co-operative, compelled and voluntary activities of wide diversity and application; in a word, on an intelligent, organized, vigorous food administration. Or, as it may now be written, Food Administration.

For the people of this country have called for an organized food control, just as the people of Italy, France and England each successively saw the necessity, called for and were given it—and the people in Germany were given it without calling

for it. Almost certainly none of these peoples could have maintained itself in the war without governmental food control. And so our people have got, as hoped-for solution of their problem, a United States Food Administration. What is it? What *may* it do? What *can* it do? What is it doing?

On August 8th of this year, just four months after our entrance into the war, Congress passed the "food control bill" introduced in the House on June 11th. The delay in passage of the bill was chiefly due to a reluctant Senate. On August 10th President Wilson signed the bill, and on the same day appointed Herbert Hoover to be his representative as head of the Food Administration with the title of Food Administrator. England's food head, at present Lord Rhondda, is officially entitled Food Controller; France's administrator, M. Violette, is called *Ministre du Ravitaillement*; Italy's, Onererole G. Canepa, is known as *Commissario Approvvigionemente*. On August 12th Mr. Hoover formally announced the policy and general plans of the Food Administration.

It should be interesting and profitable to present here a brief analytical summary of the bill.

Congressman Lever, chairman of the House Agricultural Committee, in introducing the bill, described its intent as follows:

"It aims to facilitate and clear the channels of

distribution to prevent hoarding; to prevent wilful destruction of necessities in order to enhance the prices or restrict the supply thereof; to eliminate injurious speculation; to regulate exchanges and boards of trade in order to prohibit undue fluctuation of prices, unjust market manipulation, or unfair or misleading market quotations; to reduce waste, including the power to regulate or completely to prohibit the use of cereals in the manufacture of alcoholic beverages; and to stimulate production by securing the farmer a reasonable profit guaranteed by the government, and a free and open market for his products, unrestricted by manipulation and uncontrolled by gambling operations."

The act authorizes a governmental control over the supply, distribution and movement of all food, feeds and fuels, and all machinery, implements and equipment required for their actual production. Any agency necessary to carry out their control may be created; any existing department or agency of the government may be used.

All destruction of food or fuel for the purpose of enhancing prices is prohibited; all wilful waste, all hoarding, all monopolization, all discrimination, and unfair practices, all unjust charges in handling and dealing in food and fuel, and all combining to restrict the production, supply or distribution are made unlawful.

All manufacture, importation, storage and distribution can be carried on only by license when the President shall deem it essential to institute such licensing. Exception to the license requirements is made in favour of farmers, co-operative associations dealing with products produced by their members, and retail dealers whose business is less than \$100,000 a year.

Food, feeds and fuel necessary for the army, navy and public service may be requisitioned. Hoarded supplies may be seized, sold and distributed. The government may purchase, store and sell at reasonable prices, wheat, flour, meal, beans and potatoes. Factories, packing houses, pipe lines and fuel mines may be taken over and operated by the government for any time necessary to secure adequate supplies for the public service.

Regulations may be issued to prevent speculation, manipulation, enhancement, depression or fluctuation of prices, and to control the operation of exchanges, boards of trade, and similar organizations dealing in food, feeds and fuel.

For the purpose of stimulating production the government may guarantee for a period of not longer than eighteen months a price which will insure the producer a reasonable profit. The price of the 1918 crop of No. 1 Northern Spring wheat is fixed at two dollars per bushel at principal interior

markets. The importation tariff on food, feeds and fuel may be increased if considered necessary to prevent undue importation from other countries.

No foods or feeds shall be used for the production of distilled spirits for beverages. No distilled spirits may be imported. All distilled spirits in bond or stock are commandeered and any of these stocks may be re-distilled to meet the requirements of the government in the manufacture of munitions and military and hospital supplies.

Particular powers are given in regard to the production and dealing in coal and coke. Prices may be fixed. If these prices are not conformed with, the mine or plant and business of the offending producer may be taken over. If deemed necessary the producer of coal and coke may be required to sell solely to the government, and the government may act as the sole dealer in the resale of the supplies. The government is authorized to purchase nitrate of soda to increase agricultural production in 1917 and 1918 and sell this fertilizer for cash.

In all cases where a commodity or operating plant is requisitioned just compensation is to be made.

Appropriations are made to carry on the business operations authorized in the act, and for the special purchase of nitrate of soda, and for the general expense of the Food Administration.

The statutory powers of the Food Administra-

tion seem, at first examination, to be all that are needed. Their enumeration answers the query: what *may* be done. What *can* be done is, of course, another matter. The Food Administration *may* stimulate production; can it? It *may* prevent all hoarding, manipulation and profiteering; again, *can* it? The answer does not depend on the Food Administrator alone. It depends much more, indeed, on the people of the country. We are patriots enough to stand up with the right music; to float the flag; and to yell when the soldiers go by. We are even patriots enough to offer our lives to our country. Are we patriots enough to stand without flinching when our pockets and appetites are touched? We shall see.

The Food Administration has made a vigorous beginning. The long, vexing, injuring delay in the passage of the bill was not all lost time. The Food Administrator (to be) was getting a good ready. He made the beginnings of his volunteer organization; he found temporary quarters, beginning with three rooms in a Washington hotel, and moving about with his growing staff as eviction followed eviction from other temporarily loaned resting places. The day after the bill was signed things began to happen officially; their beginnings had already been made unofficially.

As wheat — always to be thought of in terms of

bread — is of first importance, so its consideration came first on the program. At this writing, one month after the passage of the bill, a "fair price" of \$2.20 a bushel has been fixed for this year's crop by a committee selected by the President, composed of producers, wheat handlers, consumers and representatives of labour. Congress had already fixed by the terms of the Bill a price of two dollars per bushel for the crop of 1918. It was therefore necessary that a price not less than that be fixed for this year's crop in order to prevent hoarding of the 1917 wheat until next year.

A great Food Administration Grain Corporation and a Food Administration Milling Division have been formed to control the handling, purchase, sale, distribution and export of wheat and flour. As a first and immediate result of the work of these two co-operating bodies of the Food Administration, flour is today being sold to the consumer at three dollars a barrel less than it was before their organization, and the producer is getting an increase of price for his wheat equivalent to three dollars a barrel as interpreted in flour. That is, a middleman profiteering of six dollars a barrel has been wiped out.

Licenses are required (as from September 1) from all operators of elevators and all millers operating mills of over one hundred barrels daily ca-

pacity. The first regulations put into effect under this licensing system were the requirement of fair trade practices, and that no wheat or rye should be stored in elevators for any one except the Food Administration for more than thirty days. Also no mill may sell flour for shipment farther ahead than thirty days, nor may any mill, except by special permission, accumulate or own more than the equivalent, in wheat and flour, of its output of thirty days. The object of specific regulation is to prevent the public facilities for grain marketing to be used for hoarding or storing for an advance.

In the hands of the Grain Corporation is lodged by agreement with the Allies all the export buying for them. The buying for neutrals is also controlled because export licenses can only be had with the approval of the Grain Corporation.

The whole, and the only, purpose of the power and activities of the Grain Corporation and the Milling Division is to conserve as effectively as possible the wheat supply of this country for the use primarily of ourselves and Allies. It is intended that the American mills should handle a larger part of the wheat than before so as to retain the grain offal (mill feed) for our dairy cattle, and also reduce the milling cost per barrel of flour by virtue of the enlarged production. The miller will be defi-

nitely controlled as to the amount of profit per barrel which he can make.

That this is all well understood and agreed to by the grain men and millers of the country is shown by the passage of the following resolution by a large group of grain men representing all phases of the industry after a conference with Mr. Hoover and other representatives of the Food Administration in Washington, on August 15.

Realizing that the operation of Government control in wheat and rye is essential under present war influences in order to adequately protect our home supply and furnish our Allies with the aid we owe, and realizing that the establishment of an efficient government plan of operation means to all of us curtailment of our business and to some of us actual retirement from active business during such period, we do express our pride in the character of service tendered by the grain trade in the sacrifice by these men of ability who are placing their experience and energy at the service of their Government, and that we approve the general plan of operation as explained to us today as being sound, workable and necessary, and in its general lines it appears to us as being the most efficient and just plan of operation which we can conceive.

The great mass of the people in this country will be interested primarily in the Food Administration's work on wheat and flour from the point of view of buyers and consumers of bread. Can bread be made cheaper without being made less nutritious and palatable? The Food Administration is giving

much time and energy to the bread situation. It has a special division, manned by a group of business men and food experts, which is giving its whole attention to the problem of cheaper bread. A careful study of the methods of commercial and home baking is being made.

The first result of an investigation of thirty bakeries in or near New York, Philadelphia, Washington and Chicago revealed a surprising variation in several items of costs in commercial bread-making and distribution. This study shows clearly that those bakeries which have standardized their product and deliver in large quantities only once a day are making bread and distributing it at from one to two cents a pound cheaper than those bakeries that make many kinds and sizes of wheat bread and deliver in small quantities several times a day.

The investigation is being extended to about 250 bakeries scattered all over the country, but it is already plain that one of the important factors in any reduction of the price of bread is that of simplification of baking and economy of delivery. And the Food Administration is hard at work with the commercial bakers of the country trying to effect arrangements to this end. It has engaged the assistance of the "chain stores," and is well on the way to seeing a cheaper standard loaf put on the market for those who are willing to pay cash and carry the

bread home for the sake of a material saving of money.

Another staple which has had the immediate attention of the Food Administration with swift and positive results in the way of control and price reduction, is sugar. The control of sugar presents a problem fundamentally different from that presented by almost any other commodity because of the fact that about fifty per cent of the sugar we use is imported. In fact the New York price of sugar is based primarily on the conditions of the Cuban supply. It is the intention of the Food Administration to try to arrange a voluntary agreement with the Cuban government and planters to fix a price for Cuban sugar in New York that will be satisfactory to the Cuban growers and at the same time insure a fair price for the consumers of this country. There is every reason to believe that such an arrangement can be effected.

In the meantime a satisfactory agreement has been reached between the Food Administration and the sugar beet growers of America — representatives of all the beet producers of the country participating in this arrangement by voluntary agreement — by which the sale and distribution of the entire beet sugar production of the United States are placed in the hands of the Food Administration. As a result, all the beet sugar of the country is to

be sold at a price not to exceed $7\frac{1}{4}$ cents a pound, cane basis, at sea-board refining points. The price was 9.15 cents but a short time before the arrangement was made.

To control the distribution and effect a fair division of the sugar from America and its possessions and from Cuba and the West Indies, an International Sugar Committee representing the Allied governments and the United States has been formed which will have in its hands entire charge of the purchase and distribution of all sugar for this and the Allied countries. Three of the five members of this committee are Americans, one of whom represents the Food Administration, and they will act as a sub-committee to handle and decide purely domestic questions with which the Allied members are not concerned. A special committee representing the American refiners has also been formed to co-operate with the International Committee in the distribution of that part of the imported sugar that comes to the refineries in the United States.

The control of the meats and fats situation is under way of organization, but any statements regarding the course of the negotiations would be premature at time of this writing (September). Many conferences have been held in Washington between officials of the Food Administration and representatives of the live-stock growers and the

packers, and carefully elaborated plans are under present consideration. The situation is a more complex one than that of sugar or even of wheat, but some sort of early solution is necessary and will be effected.

Besides the special divisions of the Food Administration already referred to giving their whole attention to the staples, grain, meats and sugar, there are well-developed working divisions, headed and largely staffed by volunteers,—as are the grain, meat and sugar divisions,—devoting their attention to wholesale groceries and their distribution; to fish, to canned goods, to potatoes, to dairy products, and to fresh fruit and vegetables.

All of these are struggling with the general problems of monopolization, hoarding, injurious speculation and manipulation, and distribution, and in addition each has its own particular problems peculiar to the special commodities and trade in its purview. In all cases the work is moving forward on the basis of a large degree of co-operation and voluntary agreement on the part of the trade interested. Literally scores of conferences have been held between representatives of the Food Administration and representatives of the trades, and a steady advance toward the desired ends of the Administration and the advantage of the people as a whole in their great war undertaking has been, and is being, made.

The two cardinal principles guiding all this work and that are being urged on the producers, traders and consumers alike are *economy* and *service*, to the end that the foodstuffs of the land may be distributed as equitably as possible and at the lowest prices consistent with justice to all concerned. The war — and it is a relentless war — that the Food Administration is carrying on in its work with the handlers of food is against manipulation and speculation, against all forms of “profiteering.” It is a war for the protection of the consumer. At the same time the Food Administration is trying to extend favour and aid to producers along all lines leading to stimulation of production. These include all effort possible for the determination and maintenance of fair prices for the produce of farm, garden, orchard and factory, and the establishment of a regular and stable market.

There are necessarily other divisions of the Food Administration besides the ones devoted to special commodities. There is a statistical division, a legal division, a transportation division, a division of food use and scientific research in food values, a division of labour, and one of imports, exports and embargo, acting in close connection with the Departments of Agriculture, Commerce and State, with a firm grip already on the spiny problem of export to European neutrals with its serious corol-

lary of — let us put it bluntly — export to Germany.

There is a states organization division connecting directly with a federal food administration in each state, directly representing the Food Administration. Through these state administrators, who are men of demonstrated ability, high standing and influence in their respective states, all serving as volunteers without compensation for the duration of the war, there is being developed co-operation and effective team work between the central administration at Washington and the work in each state with the special food problems peculiar to each region. These state administrators come to Washington repeatedly to report and confer, and representatives from the states organization division go out to the various states, so that close touch may be maintained with conditions all over the country.

Finally there is a large and driving division of food conservation, *sensu strictu*.

It is this department that connects the Food Administration immediately with all of the people. We are all consumers, and food conservation, in its special sense, concerns itself primarily with food consumption. The primary object of this special part of the food conservation campaign is to bring about an intelligent voluntary rearrangement of the eating habits of our hundred million people so that

the particular foodstuffs most needed by the Allies can be accumulated. This has to be done in the face of a normal surplus — which has to be made larger — and by a people long accustomed to a food use limited chiefly only by its cost.

To do this it is first necessary to convince our people that food is a decisive factor in the war, that the strength of our Allies can only be maintained by a food provision meeting their minimum necessity, and that it is our duty and opportunity in this war to insure this food supply. Food conservation becomes, then, a patriotic service.

Next, it is necessary to point out how each household and public eating-place, and how each individual consumer can really act so as to conserve food. The details and special efforts centre about three principal general propositions: the elimination of waste, the substitution of certain foods for others, as corn for wheat, poultry for meat, etc., and, finally, an actual lessening of unnecessary consumption. To instruct and enlist the nation the already organized forces of the people are brought into play. The special help of community centres and state organizations, of the public school teachers, the churches, the fraternal orders and patriotic societies, has been enlisted.

The participation of the churches in the work, in particular, is already highly developed. Officially

appointed representatives, including some of the most prominent men in each of the denominations, have met with the Food Administrator and his staff in Washington, and after coming to a clear understanding of the situation have tendered the largest service of their organizations. Eighteen men representing fifteen denominations are continuously in Washington with offices in the Food Administration buildings giving their whole time to the great campaign of food conservation appeal and education among the forty million church members officially represented by them. It is a fine exhibition of the patriotism and practical possibilities of the American churches when appealed to for national service.

No less important, the active co-operation of the women of the country has been obtained. Representatives of all the great national organizations of women have come to Washington for repeated conferences. A general agreement and plan for co-operation has been arrived at, and a splendid volunteer staff of women representing various special interests and activities is giving devoted service to the work in the Washington offices of the Food Administration.

A national lecture bureau has been organized, as have also numerous State bureaus. Work in home economics is being conducted by experts. Simple primers and text books and lecture course syllabi

for the public schools and colleges have been prepared and issued. Cards specifying the particular measures most available and effective for food-saving and wise food use in the homes and public eating-places are being sent broadcast, and pledges to observe these suggestions are being signed by millions of households, hotel, restaurant, dining-car and club managers, and individual consumers.

These pledge signers are enrolled as members of the Food Administration, and receive cards of membership which they are asked to display in their windows, so as to announce their patriotic undertaking and thus serve as a good example to others.

The results of this great campaign are already obvious. An actual food-saving, a food conservation, is being effected. This is shown concretely by interesting statistics recently collected from sixty cities that reveal a lessening of the garbage collections by about 12 per cent, as compared with those of last year. Quite as important, a psychological effect is being produced. Food conservation is making the war real; it is inspiring patriotism. It offers the opportunity for universal service in a great national endeavour; and it is creating this service. Incidentally, it may mean much for the years after the war; we may get the food-saving habit—and the habit of patriotism.

Another phase of food administration is that of

the stimulation of production. Under the provisions of the so-called "food survey bill," signed on August 10, the Secretary of Agriculture is authorized to investigate in detail the actual food situation in the country and to employ a variety of special measures, such as special furnishing of seed, demonstrations, and enlarged efforts at education for increasing the food production. This work does not come under the immediate control of Mr. Hoover's organization, but it is a matter in which the Food Administration is vitally interested, and in which it will take every opportunity to assist and to co-operate with the Agricultural Department. There has already been a notable response of the people to the call for increased production, evidenced by the two million or more new back-yard and vacant-lot gardens planted this summer. And there is plain promise of increased acreage for the 1918 crop of grain. The guaranteed minimum price to the farmers of \$2.00 a bushel for the wheat of the 1918 crop, fixed by the food control bill — and this whether the war ends before the harvest with the consequent tumbling in price all over the world, or whether it does not — leads experts to estimate that our wheat crop of next year will reach a billion bushels, weather conditions permitting.

CHAPTER III

HOW ENGLAND, FRANCE AND ITALY ARE CONTROLLING AND SAVING FOOD

A PERTINENT question, whose answer has been as yet no more than indicated in this book, is that concerning the food conservation by the Allies. Americans who are asked to limit their consumption of bread, meat and sugar for the sake of supplying our Allies with food will want to know what the Allies themselves are doing in the way of food economy. That each of them has a governmental food administration has already been said. Each of them began its food control under some already existing government department. But each of them has come to the realization of the necessity of setting up what is essentially an independent governmental organization for food control.

It may be said at once that all these food administrations of the Allies are vigorous ones, and their actions drastic. They use some methods that will not be used here. They regulate the food use in public eating-places such as hotels, restaurants, clubs, etc., by direct and specific decree of the food con-

troller. And, in lesser degree, they regulate the food use of the people in their homes also by government decree. As regards certain foods they practically put the peoples of their countries on rations. However, they all place their greatest reliance, as we shall do here, on the voluntary co-operation of the households to effect the needed care in the food use of the people at home.

ITALY

England and France have gone farther in some respects than Italy in food regulation, but numerous recent decrees of the Italian government show a plain tendency to bring its control of food up to the standard of its Allies. As a matter of fact, the government is seriously considering at the time of this writing (September) the adoption of a definitive rationing scheme to cover all the more important food staples such as bread, meat, fats, sugar, etc. Even now certain Italian cities are on ration as regards flour and bread. The adoption of such a system will carry Italy's control beyond anything yet adopted by England or France.

As early as the summer of 1915 Italy took active measures to establish a general reorganization of food importing and distribution under government control, and to authorize governmental requisitioning of produce and food businesses, the fixing of maximum sale prices and a provisional system of

rationing applicable to local centres. Since then there has been a constantly increasing governmental control both of food handling and food consumption, first administered by the department for agriculture, but in January of this year put under the special supervision of a Commissary General of Supplies, an office filled since its creation by Onerevole Giuseppe Canepa, Under Secretary for Agriculture.

The care of grain and its milling has been from the beginning a matter of especial solicitude, as it has in all of the countries undertaking governmental food control. The reason is fully indicated by the single word, bread. Minimum prices to stimulate production, maximum prices to protect the consumer, and requisitioning of native and imported cereals to regulate distribution have all been provided for. "Grain Assemblies" have been instituted in the various provinces, each of which attends to the supply and distribution of cereals and flour within the limits of its province.

The wheat must now be milled at 90 per cent (which means that only 10 per cent of the whole wheat kernel does not go into the flour). The milling percentage was first (March, 1916) put at 80 per cent, then later 85 per cent, and on May 29 of this year at 90 per cent. It is the highest per cent used by any of the Allies, which means that Italy's

war bread comes nearer than either England's or France's to being whole wheat flour.

Bread must be baked in the form of a smooth loaf of a fixed minimum weight. The weight was first put at 700 grams (24½ ounces) and is now 250 grams (8¼ ounces). Bread may not be put on sale or given for food until the day after it is baked, and it may not be treated by special processes to keep it fresh. The time for baking is limited to between 10 A. M. and 9 P. M. and its sale and distribution must cease on week days at 1 P. M. and on Sunday at mid-day. No sweet pastries may be made. The manufacture of gluten cakes for the sick is permitted, but the gluten must be derived from the regular war flour, i.e., flour from 90 per cent milling.

Especially drastic regulations govern the use of sugar. Its manufacture, distribution and sale are closely controlled, and partly actually taken over by the State. The government is trying to limit the consumption to 15,000 tons a month for the entire population, army included, which means an allowance of about 500 grams (1½ lbs.) a month, or thirteen pounds a year for each person. We use eighty pounds a year per person! Sugar cards are in use in the principal cities. The manufacture and sale of candies and sweets of any kind except chocolate in small tablets and certain medicated pastilles

and lozenges are prohibited, and the use of sugar in any manufactured products is greatly restricted. Saccharine is permitted to be sold and used as a substitute for sugar, and the government manufactures a mixture of saccharine and sugar called "state sugar."

Various special regulations govern the slaughtering of animals and the use of meat. There is a regulating committee in each province which determines every now and then the limit to be set on meat consumption, by fixing figures for the total number and weight of sheep and cattle which may be slaughtered for the immediate needs of the civil population and the canning of preserved meat. It has recently been decided that the number of cattle to be slaughtered monthly should be determined on the basis of a national meat rationing system. Since May, 1915, it has been unlawful to slaughter calves of less weight than 200 kilograms (440 lbs.) on the hoof, or swine of less than 75 kilos (165 lbs.) or lambs of less than 10 kilos (22 lbs.). The sale of fresh meat for the use of public eating-places is prohibited for two consecutive days per week. In the army some of the meat ration for the territorial troops has been replaced by *minestrone*, a soup made of rice, vegetables, etc. For the troops on active service salt fish has been substituted for part of the meat ration.

The use of eggs in the manufacture of sweet stuffs has been restricted, and preference in the distribution of eggs to invalids, children and nursing mothers has been ordered. Since the end of 1916 the exportation of cheese has been prohibited for the sake both of lessening its production and for restricting certain forms of hard cheese to the use of the army.

The control of public eating-places is rigorous. The serving of butter, fresh or salted, of cream and whipped cream, and of dishes garnished with eggs is prohibited. Sweet dishes also are prohibited except on Thursdays and Fridays, and then may be served only at dinner. A fixed price lunch may not comprise more than two dishes, and a dinner more than three, of which in each case only one may be a meat dish. Similarly, a person ordering *à la carte* may not have more than three dishes of which but one may be meat. All public eating-places must hand to the police every day a copy of their bill of fare, and the whole bill may not list more than ten dishes, of which no more than four may be meat. Public eating places must close not later than eleven o'clock and may not open before dawn. However, the railway station restaurants may open one hour before the departure of the first train and remain open one hour after the departure of the last train, provided that the only entrance to the res-

taurant is from inside the station, thus limiting the patrons to passengers and station employés.

The attempt to stimulate production by the establishment of minimum prices to the producers has been referred to. These prices have had to be increased from time to time. For example, by decree of January, 1917, the minimum prices of cereals to be observed in all requisitioning of the 1917 crop by the government for the army of civil population, and in all civil contracts, were as follows: Wheat, soft or semi-hard, 45 lire per net quintal; wheat, hard, 50 lire; corn, 33 lire; oats, 33 lire; barley, 40 lire; rye, 40 lire; and rice, 37 lire. In July, 1917, the prices for the 1918 crop were established as follows: Wheat, soft or semi-hard, 52 lire per net quintal (220½ lbs.) (equivalent to about \$1.87 a bushel); wheat, hard, 60 lire (about \$2.18 a bushel); corn, 38 lire, (about \$1.31 a bushel); oats, 38 lire (about 74 cents¹ a bushel); barley, 43 lire (about \$1.25 a bushel); rye, 43 lire (about \$1.48 a bushel). These prices are increased

¹ This difference in dollar price per bushel of oats from that of corn which has the same price in lire per quintal as that of oats is explained by the fact that while the quintal is a weight measure, being equivalent to 220.46 lbs., the weight of a bushel varies with the different grains. A quintal of oats makes about 67½ bushels, while a quintal of corn makes but 37½ bushels. In these computations a dollar is taken as 7.45 lire, the exchange rate at the time of this computation (August, 1917).

by from 20 to 30 centesimi a month for deliveries made after August 1, 1918. Minimum prices have also been fixed for grain-straw and horse beans.

Where the farmer produces crops either in excess of normal production or under unusually difficult conditions the prices fixed by the government may be ten per cent in excess of the regular official rate. The government may determine the amount of increased acreage which any farmer or association should cultivate. It may also require the land-owner to allow an increased area to tenants. Finally, a government decree of June, 1917, strongly encourages users of agricultural machinery. Societies, companies and agricultural associations are granted concessions up to 30 per cent of the amount expended for the purchase of tractors and mechanical ploughs, and in the case of machines worked in groups of five or more, 40 per cent of the cost is allowed as subsidy. This measure has given great satisfaction to the Italian farmers and is having an important influence in the increase of cereal production.

FRANCE

The chief responsibility for carrying out the measures adopted by France for stimulating its food production and controlling its food consumption lay, from September, 1914, to January, 1917, with

the Ministry of Commerce, Industry, Posts and Telegraphs; then from January, 1917, to March 20, 1917, with the Ministry of Public Works, of Transports and Provisioning, and has been since March 20 with a specially created Ministry of Provisioning and Maritime Transports. M. Violette has been the Minister in charge since the creation of this special Ministry, until the time of this writing (September) when, in the formation of the new cabinet under M. Painlevé, he has been succeeded by M. Maurice Long.

The swift falling off in the food production in France, beginning with the crops of 1915 and progressing ever more seriously in 1916 and 1917—the wheat acreage of 1917 is but two-thirds that of the pre-war acreage—has claimed a constant attention and led to a long and important series of actions taken to check it. Measures for the stimulation of production figure conspicuously in the long list of regulations. And yet despite them France suffers more than either of her Allies from the falling off of native production. The explanation is ready to hand: She has contributed more of her man-power to the fatal trench lines, and sent this man-power sooner; also, an appreciable fraction of her cultivated lands are in the hands of the invaders.

The many measures undertaken to stimulate pro-

duction refer to labour, to methods of cultivation, including use of machinery, and finally to the utilization of waste lands. Numerous special agricultural commissions, from national to cantonal and communal ones, have been formed; the government has given financial assistance for the purchase of tractors and other needed farm machines; has arranged for special furloughs at seeding and harvesting times of agricultural labourers in the army, and even the entire removal from the army of the agricultural workers among the earlier classes (older men); and has established fixed minimum prices to be paid the producers of cereals and other crops for government requisition.

These cereal prices have been changed, always increasing, several times. The last fixation of these prices was in July of this year and is as follows: Wheat, 50 francs per 100 kilograms (about \$2.64 a bushel); barley, 42 frcs. per 100 kilos (\$1.76 a bu.); corn, 42 frcs. per 100 kilos (\$2.06 a bushel); rye, 42 frcs. per 100 kilos (\$2.06 a bu.); oats, 42 frcs. per 100 kilos (\$1.14 a bushel). This is a very large increase over the prices existing before this time, which were 36 francs per 100 kilos for wheat, 34 francs for oats and barley and 33 for rye; there was no minimum price for corn. These earlier prices were for the 1917 crop and dated no farther back than April of this year. The meaning

of this great jump is plain; it is that the previous prices were not sufficient to induce the farmers to devote their attention to the cereals and thus increase the native crop of bread and feed grains.

The measures undertaken to control the commercial operations in foodstuffs begin, seriously, with a law passed in October, 1915, giving the government the right to requisition wheat and flour for the civil population at a fixed price — the right of requisition for the army is of long standing — and to buy these commodities abroad, and distribute the government supplies thus obtained according to the needs of the population. In April, 1916, a similar law was passed for the other cereals, rye, oats, barley, and bran. A series of ministerial decrees based on these laws set out the methods and details to be followed in carrying out this radical substitution of a governmental operation for the ordinary commercial methods of supplying the people of France with their bread-stuffs.

Laws and decrees regulating milling and baking followed rapidly, and a long series of orders establishing and enforcing maximum prices of various commodities came into being and is still being added to. The most inclusive maximum price law is that of April 20, 1916, which authorizes the fixing of maximum prices during the war and for a period of three months after the cessation of hostilities,

for the following commodities: coffee, oil and gasoline, potatoes, milk, margarine, alimentary fats, salad oils, dry vegetables, commercial fertilizers, sulphate of copper and sulphur, as well as bread and meat. Also this law authorizes generals of the army and commanders in the region of the North to fix the maximum prices on all food and liquor destined to military consumption in the districts under their command, even if these foodstuffs are not included in the list of commodities above. They may also establish a maximum price on all foods and liquors destined for the civil population, after having consulted with the prefects.

All of the maximum price laws and decrees which are intended to suppress illicit speculation and to prevent inflated profits have been subject to much discussion. Some of them have even been revoked; and some of the maximum prices have been abolished, as, for example, those for potatoes, milk, butter and cheese of all kinds. The outcome of the whole French debate is an agreement with the conclusion reached in other countries, namely, that maximum price measures can be enforced with success only in the case of commodities the supply of which is under the control of the government. Where the supply is not thus controlled, maximum price measures afford little relief. If not considered high enough by the producers, they tend to force

the commodities covered by them out of the open market.

The regulations that France has established for the control of the immediate consumption of food-stuffs fall into various categories as regards the nature of the control exercised. But it will be more convenient and informing to describe the more important of these regulations according to the commodities and the individuals affected.

Wheat is now milled at 85 per cent. It has been successively changed from 74 per cent to 77 per cent to 80 per cent and finally, May, 1917, to 85 per cent. Flour made from other cereals must be mixed with this wheat flour to the amount of 30 per cent. The flour must be furnished by millers only to certain designated bakers in each Department and each baker may sell his bread only to certain households and individuals placed upon his lists. All bread must be made of the war flour, and no pastry or fancy cakes may be made. The bread is distributed on a bread card system, which permits each child of from one to six years to have 300 grams ($10\frac{1}{2}$ oz.) of bread a day; and each person over six years, 500 grams ($1\frac{1}{10}$ lbs.) of bread a day. Certain supplementary amounts may be furnished under certain conditions, as well as small supplementary amounts of flour for cooking. Careful arrangements are made to see that hotels, restaurants, etc.,

are given only as much bread as their patronage warrants. This bread must be sold by the baker for 45 centimes (just changed to 50 centimes) a loaf of one kilogram (2.2 lbs.) weight, which is less than he can make it for. The difference is paid to the bakers by the government.

Various decrees regulate the consumption of meat. A decree of October 14, 1915, prohibited the killing of heifers of less than two and a half years of age; of lambs weighing less than twenty-five kilograms (55 lbs.); and of pigs weighing less than sixty kilograms (132 lbs.) In April of this year the sale of fresh, frozen, salted or canned meats on Thursday and Friday of each week was prohibited as from May 15 to October 15. It was also prohibited to sell meat or dishes containing meat on these same days in public eating-places. All butcher and sausage shops, and meat booths in markets, must be closed on the days that the sale of meat is prohibited. Special exceptions are made for the sale of meat for the sick and to hospitals. Slaughter houses must be closed each week from eleven o'clock Tuesday night until six o'clock Friday morning, from May 15 to October 15. A later decree provides that the serving of meat is prohibited at all meals served after six o'clock except Sundays. Also, beginning April 25, all butcher shops and meat booths in markets must

close every day at one o'clock. This order revoked the decree of ten days previous creating two meatless days a week. On May 14, a new decree revoked most of the decree of April 24 and re-established most of the decree of April 14. The results obtained from prohibiting the consumption of meat after six P. M. every day except Sundays in public eating places, and ordering all butcher shops to close at one o'clock were not satisfactory. In consequence, new measures of regulation were set out. These provide that on two consecutive days each week all slaughtering, sale and consumption of meat in public establishments, horse meat alone excepted, shall be prohibited.

The sugar production of France has fallen off from an acreage of two hundred and fifty thousand hectares in 1913 to seventy-two thousand hectares in 1917. To restrict the consumption of sugar, sugar cards are used allowing the purchase of but seven hundred and fifty grams of sugar a month per person. This means an allowance of about one ounce a day or eighteen pounds per year for each person. Let us recall again that in America we use about eighty pounds per person a year. But the possession of a sugar card does not necessarily mean that one can buy sugar. To buy it one must find it to sell. A dealer who has sugar will not sell it to any one who comes in. He saves it for

his regular customers. During the fruit months of June, July and August an additional allowance per person of five hundred grams a month was made for preserving fruit and making jams and marmalade. A scale of maximum prices for the different grades of sugar has been in effect since July. By a law passed in April, the employment of saccharine in the preparation of certain sweet products has been permitted. Since July there has also been a scale of maximum prices for saccharine, the price varying with the amount purchased.

In order to control the use of animal feed, a decree of July, 1917, specifies the amount of feed which can be given to various domestic animals, according to their age and size. In other words, all domestic animals in France are put on rations.

By order of January 25, 1917, all public eating places are subject to regulation, beginning February 15, which limits each person to two dishes, of which only one can be meat, at each meal. Provision is made for additional dishes of soup or hors d'œuvres and cheese or dessert. Each public eating place is required to send daily to the police a copy of the bill of fare. A later circular authorizes the substitution of snails or oysters in place of hors d'œuvres, prescribed in the earlier order, and allows the meal to include both cheese and a dessert instead of only one of these. Bread must not be furnished

free in the restaurants, but must be sold at five centimes a slice.

ENGLAND

After a visit to London in May of this year M. Violette, the French Minister of provisioning, told the Paris correspondent of the *London Times* that one of the most interesting differences he had noted between the attempts at food control in France and England was that the restrictions in England are largely of a voluntary character. When he was in London, he said, he found that none of the restrictions interfered with his ordinary habits. At home it was different. France had already put into force a large number of governmental measures which directly controlled the food purchasing and consuming habits of the individual.

It is true that France began the issuing of governmental decrees affecting food immediately after the outbreak of the war, but earlier ones had chiefly to do with the assembly of information concerning the food resources of the country, and it was not until the latter part of 1915 that the long series of more important and drastic regulations now in force began to be formulated. England began later with her regulations, but in the last few months she has established so many and such drastic ones touching the specific control of food use that it is doubtful

if M. Violette were to visit London again now that he would find England very different from France in respect to regulation of the individual food habits.

The food problem of England did not become acute until some time after the war began. Certain measures of governmental food control were early undertaken, as the two acts of August 10 and 28 respectively directed against "unreasonable withholding" by dealers of any foodstuffs, giving the Board of Trade authority to seize, on payment of a reasonable price, any such hoarded supplies. But no actions were taken under these laws. The prohibition of importation of sugar from any European port was declared by proclamation of September 14, 1914. In the same month followed the establishment of a Royal Sugar Commission, and in October sugar imports from any foreign country were prohibited without special license from this Commission. These were actions primarily designed to check trading with the enemy, and real food conservation measures were not actively undertaken for nearly two years. Beginning with October, 1916, however, laws and decrees were rapidly passed and issued until now England has a series of food regulations hardly less long and comprehensive than that of France. In addition, her appeals to the voluntary co-operation of

her people have been the most detailed and made with the most elaborate machinery of propaganda of any of the Allies. Her first activities were in charge of the Board of Trade, but in January of the year (1917) a special Ministry of food was established with Lord Devonport at its head as Food Controller. In July Lord Rhondda succeeded Lord Devonport in this office. The Food Controller has great powers. In respect to requisitioning and controlling prices his powers are as large as those of the Admiralty, Army Council or Minister of Munitions. He may make absolute orders controlling the production, manufacture, storage, transport, distribution, purchase or sale, use and consumption of any article of food. He is not a food controller; he is literally a food dictator.

Among the various phases of food legislation that of the stimulation of production by the establishment of guaranteed minimum prices to the producers of grain, and minimum wages to agricultural labourers, and by direct governmental aid to the farmers for acquiring grazing lands to plough up and machinery for farm work has been one given special attention by the English government and with notable success. In April, 1917, the most elaborate and far-reaching scheme of stimulation of production yet adopted by any government was

undertaken by the passage of the "Corn Production Bill." It provides for the guarantee to grain farmers of a sliding scale of minimum prices for wheat extending over six years, as follows: harvest of 1917, 60 shillings per quarter (\$1.78½ a bushel); 1918 and 1919, 55 shillings per quarter (\$1.63½ a bushel); 1920, 1921 and 1922, 45 shillings per quarter (\$1.33½ a bushel). Specified minimum prices for oats were also declared. Also a minimum wage of 25 shillings a week was guaranteed to agricultural labourers through this period.

England has always had an undue proportion of grazing land to cultivated land. While Germany has nearly 50 per cent of her total area under actual cultivation and France has 45 per cent, England has a little less than 25 per cent. But England's active measures, especially during the last few months, have notably increased her grain and vegetable producing acreage. Mr. Lloyd George declared in a speech to the House of Commons on August 16 of this year that whereas in December, 1916, the cultivated area was between two and three hundred thousand acres less than in December, 1915, it is now one million acres larger than last year. This means an addition of between three and four million tons of grain and potatoes to England's food supply. It is confidently expected that the increase in area cultivated for the 1918 crops will

be no less than two million acres, and more probably will reach nearly three million.

This is being accomplished by the minimum prices order, by the enforced allotment, by counties, of grazing and waste lands to be broken up and cultivated, and by the re-allotment of badly farmed land, and the restriction of acreage for "luxury" crops and hops and the devotion of the land gained to staples; by extending credit to farmers, and by the practical compulsion of farmers to cultivate the land made available to them. Henry Gatley, a farmer of Cornwall, was summoned on July 31 for failure to cultivate five acres of potatoes and fined twenty pounds!

It is also being accomplished by the furloughing and return of agricultural labourers from the army,—in addition more than 100,000 women are now working at farm labour in regions where heretofore no women have been so employed; on the other hand, England, unlike Germany, is using but few prisoners of war in the fields,—by the aid of governmental establishment of well-equipped stations for drying vegetables and pulping fruit, and by the provision of seed wheat, fertilizers, horse feed and farm machinery to the farmers. Lloyd George announced in his speech of August 16 that the government had already acquired for loan to the farmers, 1000 tractors, by October would have 2500,

and by the spring of 1918, 8000. These are, of course, in addition to any increase in privately owned ones. The government has also taken active measures to rehabilitate the fisheries industry, badly demoralized by the impressment of trawlers and fishermen in the service of the Navy. By March, 1918, every English fisherman of military age will have been taken for naval service. Various laws useful in peace times for fish protection are temporarily revoked.

England's governmental control of the foreign purchase and importation, the home purchase, sale and distribution of foodstuffs is now most comprehensive. Maximum prices and sales regulation have been fixed for the sale of wheat and the other food and feed grains and their products, beans, peas and pulse, potatoes, milk, cheese, butter, lard, margarine, livestock and meats, jams and jellies, sugar, chocolate and other sweets.

All wheat is controlled by the Royal Wheat Commission, and all mills have been taken over by the government. Wheat is milled at 81 per cent and to the flour thus obtained flour made of other cereals is now added, in amount of from 30 to 50 per cent. The making of bread by bakers is rigidly controlled, and arrangements have just (September) been perfected for the sale of all bread, for cash over the counter, at the fixed price of 9d. (18 cents) a loaf.

of four pounds—the price had reached 12d. in August. To do this the government will have to make up to the bakers their loss, for with the prevailing price of flour and wages of labour, the four-pound loaf cannot be made for ninepence. It is estimated that the difference will cost the government under present wheat prices, nearly forty thousand pounds a year.

Sugar is under close control. An elaborate system of distribution based on personal sugar cards will go into effect this month (September). Each household may buy sugar only on presentation of a card; caterers will have their supplies regulated according to the number of meals served, and institutions according to the number of inmates. Manufacturers will be supplied under strict regulation and all sellers, wholesale and retail, will be able to obtain and sell supplies only under an elaborate system of registration and vouchers.

As early as the end of 1916 the government began a special control of public eating places. On December 5 the famous limitation of courses or so-called "Runciman Order" was made. This was before the establishment of the special Ministry of Food and was made by the Board of Trade, of which Mr. Runciman was head. This regulation limited all luncheons in public eating rooms

(hotels, restaurants, clubs, etc.) to two courses and dinners to three. For purpose of the order soups, hors d'œuvres not made of fish and meats, poultry or game counted as one course, as also cheese; soup if containing no meat in solid form counted as but half a course, and desserts consisting exclusively of fresh or dried fruit counted as a half course only. With any course of meat vegetables could be served. Thus for luncheon one might have vegetable hors d'œuvres, a meat and vegetable course and a pudding or tart with cheese; or a clear soup, meat and vegetable course and fruit dessert. For dinner a second meat course could be added. This order lasted just four months and was then revoked as a confessed failure. What it did was actually to increase the amount of staples as regard meat and bread consumed, lessening the use of the less important and more luxurious foods—which is exactly what England does not want to do. Wealthy persons who would normally eat several “frippery” courses at luncheon or dinner in none of which, perhaps, solid meat had a place, ordered for these two or three courses the staples and full meat dishes. As a matter of fact, it is estimated on the basis of actual figures furnished by the Association of Hotels and Restaurants of London that the limited courses order increased the consumption

of staple meats by 25 per cent, and also increased, perhaps in no less degree, the consumption of other staples, as bread, sugar, butter and potatoes.

On April 4, therefore, a new Public Meals Order (amended and amplified on May 4) was issued doing away with the limitation on the number of courses, but specifying specific maximum amounts of meat, sugar, bread and flour which may be used in public eating places, as follows: for one person, meat, breakfast, two ounces, luncheon, five ounces, dinner, five, tea none: sugar, two-sevenths of an ounce for each of the four meals; flour (used in cooking) one ounce each for lunch and dinner, none for breakfast or tea. Two ounces of poultry and game are to be reckoned as one ounce of meat. The weight of the meat is to be that of the uncooked meat, including bone, as it is delivered by the butcher. Four ounces of bread are to be reckoned as three ounces of flour. No potatoes or any food of which potatoes form part shall be served or eaten on any day except Friday. (This potato restriction was removed on July 3.) The order does not apply to boarding houses of ten bed-rooms or less, nor to any public eating place where no meal is served the total charge for which, excluding beverages, exceeds one shilling and threepence. No allowance of food is made for any meal before 5 A. M. or after 9:30 P. M.

The order therefore cuts out theatre suppers and encourages the vending of cheap meals. As a matter of fact, most of the restaurant companies, like Lyons, A. B. C., and similar ones, serving good cheap meals, immediately put on the one shilling threepence limit. The Association of Hotels and Restaurants estimates that the order will result in a saving of meat over the amount consumed before the limited courses order went into effect of forty-nine per cent and over the amount consumed during the period the limited courses order was in effect of sixty-one per cent. The saving of bread is estimated to be fifty-three per cent and sugar sixty-three per cent. Although it is too soon at this writing to make a statement as to the success of this last order we can, however, give the testimony of the managing director of the largest and best known hotel in London. He states that whereas before the order went into effect he made a weekly purchase of 13,500 pounds of meat from the Smithfield Market, he now purchases a little less than half of that amount although the number of guests in his restaurants has not been decreased. The average consumption of meat in different classes of hotels and restaurants in December last amounted to 11.79 ounces per head for luncheon and for dinner. The consumption ranged from 10.5 up to 13.72 ounces and included all classes of restaurants.

Thus, it is obvious that the five-ounce limitation means a full and immediate saving of meat used in public eating places of at least fifty per cent. The average consumption of bread was $4\frac{1}{2}$ ounces a meal, which has been reduced by the order to 2 ounces to the meal. Much of the bread formerly served was wasted. In the great hotel referred to there was about five sacks daily of 130 lbs. each of waste bread; there is now less than half a sack.

In order to conserve the food grains, orders have been issued at various times (January 11, April 20, May 2, August 14 and 15, 1917), restricting the use of these grains for seed and human or animal food. These orders of course incidentally affect the making of malt and distilled liquors. But this matter of reducing the consumption of alcoholic liquors is directly handled by several special orders, one of March 29 of this year being the most comprehensive. This order cut down the annual output of beer in the United Kingdom from the twenty-six million barrels allowed for the year ending March 31, 1916, to ten million barrels. The twenty-six millions of 1915-16 were in their turn about ten million less than the pre-war annual average barrelage, so that the allowance of ten million barrels is but $27\frac{1}{2}$ per cent of the pre-war annual average. Another order prohibited any malting of grain after February of this year. It is estimated

that the malt on hand would enable the brewers to make their permitted amounts of beer up to November of this year.

The March order also provided for a marked reduction in the deliveries of wine and spirits. Permission to receive such liquors is reserved exclusively to persons to whom wine or spirits were delivered in 1916, and the total amount permitted to be thus delivered may not be more than 50 per cent of the 1916 deliveries. Several orders variously limit the time when alcoholic liquors may be sold at retail; all treating is forbidden and a general attempt is made to reduce the opportunity and invitation to drink.

An interesting recent feature of the English control of food distribution is the creation by decree of August 17 of local food control committees over England, Wales and Scotland. Each committee will be composed of not more than twelve members of whom at least one must be a woman and one a representative of labour. Their expenses will be borne by the government. The first duty of these committees will be to administer the distribution of sugar and further the campaign of voluntary food economy. Later they will be empowered to deal with other foodstuffs, including meat and bread. They will be given certain responsibilities in regard to the enforcement of the food prices, determined

by the Food Controller, and will be asked to advise on the necessary local modifications of them. Up to the end of August more than fifteen hundred of these committees had been formed.

Finally, we must devote a few words to the great English campaign for voluntary food control. This campaign has been carried into every city and town and hamlet in the islands, and it has had real results. The Food Controller, through a special "director-general of food economy" has asked the people to restrict themselves in their homes to the same allowance of bread, meat and sugar permitted to diners in public eating places. This means four pounds of flour, two and a half of meat and one-half pound of sugar a week for each person in the household. All houses agreeing to do this receive a small placard bearing in conspicuous letters of black and red these words:

IN HONOUR BOUND
WE ADOPT
THE NATIONAL SCALE
OF VOLUNTARY RATIONS

This placard is put face outward into a front window of the house. In the short street in which I lived in London last spring three out of four houses showed the placard. In a certain village of 250 houses all but 25 displayed the card.

Altogether as a result of this appeal and an in-

dependent "Eat Less Bread" campaign the Food Controller is able to declare that fifteen per cent less bread was eaten in the United Kingdom in June of this year than in February. In some of the larger cities the consumption of bread was reduced by as much as 25 per cent to 30 per cent. Portsmouth reduced its weekly per capita consumption to 3 lbs. 1 oz. and Keighley, the "model town," to 2 lb. .07 oz. "It is perfectly safe to say," writes Director General Kennedy Jones, "that an enormous reduction has been effected through the voluntary efforts of the people in the United Kingdom in the consumption of practically all food-stuffs."

CONCLUSION

This fleeting examination of what the Western Allies are doing to stimulate food production, eliminate wasteful commercial practices and "profiteering," and control consumption, gives only a partial survey of the actual work being done. And no attempt has been made to discuss with any critical consideration the value of the methods employed and to extract the lessons to be learned by us from the experiences of our friends overseas. And yet in addition to the answering of the repeated questions of many: Are our Allies conserving food, and if so, how and to what extent are they doing it? any account of the attempts of England, France

and Italy at food control should be rich in suggestions to us of America as to what to do and what not to do in our own endeavours, only fairly begun as yet, to solve our food problem.

Take, for example, the question of the effect and the advantage of establishing maximum prices. Germany, Italy, France and England have all leaped at this presumably simple solution of the problem of profiteering and distress of the consumer. But it is now obvious that this is no simple solution; it is doubtful indeed, if under any but the circumstances of an absolute governmental control of the bulk of the commodity priced it is any solution at all. For its application immediately creates new problems; most conspicuously, the problem of keeping the commodity in the market. Fix a price for food at a price lower than the producer believes he should receive and the commodity vanishes from sight and access.

Also, we must recognize that with all the best will and best work in the world, all endeavour to keep prices down in war time is met by an irresistible force which tends to push them up. The prices of foodstuffs in the warring countries have steadily mounted until now, taking all the commodities together and striking a rough average, food can fairly be said to cost in England, France and Italy fully twice, and in Germany three times, what it

did at the time of the outbreak of the war. Bread in France must be excepted, but its continual low price is artificial; the government pays to keep it down, which means that the French people of now and to come are to pay for it by indirection. In England the bread price in 1914 was five and a half pence the four-pound loaf; this year it is twelvepence. But the government has now fixed it at ninepence and will pay the difference. War necessarily means high prices, but food control ought to mean that these prices are not *unnecessarily* high.

Again, limitation of courses seems an easy means to reduce consumption in public eating places. It is, of foodstuffs, of which we are not interested in restricting the use. But England found it actually to increase the consumption of those very all-important necessities which she wishes to conserve.

And so one might — and ought — to work over the whole mass of the Allies' experiments and experiences now available to us. We of the Food Administration are trying to do that. But we of this little book cannot undertake it. The principal fact that we may draw from the contents of this chapter is that our Allies who are asking us for imperatively needed help with their food supply,— which means, if we shall meet their call, some con-

trol and conservation of our own supply — are not asking this without making on their own part a most earnest and adventurous attempt to help themselves.

CHAPTER IV

FOOD CONTROL IN GERMANY, AND ITS LESSONS

WHEN a people is placed under limitation in the supply of foodstuffs, the correct basis for the solution of the difficulty lies in an analysis of the dietary habits of the people and of the processes of production and distribution related thereto. When one follows a particular commodity one learns, after having determined the amount produced, that the outgo follows four directions:— in food; in feed for domesticated animals; in industry; and in waste. In the conservation of foodstuffs in a period of stress, efforts for amelioration are naturally divided under the headings of production, distribution, and consumption. It is not possible within a brief space to describe in detail the methods practised by the German authorities in dealing with the conservation of the food supply under blockade by the Allies. It is, however, possible to present a sketch in broad outlines, in order that the points of difference from the control attempted by England, France and Italy, and the control now in course of being begun in our own country, may be brought out.

Germany was an importer of foodstuffs. She was an importer of bread grains, feeding-stuffs that were indirectly the basis for domestic food production, and colonial wares, such as coffee. She was an exporter, in a large sense, of sugar only. Placed under blockade, the needed imports were curtailed and the exportation of sugar abolished, though not until the second year of the war. Viewed as a unit, Germany was accustomed to import from 15 to 20 per cent of her foodstuffs. Austria-Hungary, as a unit, was an exporter of grains, sugar, and to a certain extent of animal products. In the case of Austria-Hungary the exports more than balanced the imports in nutritional values, and with the maintenance of normal efficiency the Central Empires should have been self-sustaining. They did not, however, operate in unity. Each passed laws against the other and in particular Austria-Hungary was very loath to allow foodstuffs to pass into Germany.

Shut off from importation of bread grains, in consideration of the area of Germany and the high productivity per acre under intensive methods of agriculture, it would seem that it might have been possible for Germany to have stimulated the production of grain to the point of normal consumption. The average yield in a series of years before the war was 26,000,000 tons; the average consump-

tion, 32,000,000 tons; the deficit, therefore, 6,000,000 tons. The agricultural authorities of Germany confidently expected to produce the sum represented as deficit through increased agricultural stimulation. The methods adopted were fixation of price to the producer, governmental control of seed and fertilizer supplies, governmental contributions in farm labour at the time of seeding and of harvest. The prices fixed were regarded as high, for example, the price of wheat for the current year being in the neighbourhood of \$2.30 a bushel. Governmental control of fertilizer did not mean much to the peasant, since the government had very short stocks of phosphate and nitrate, although amply supplied with potash. The peasants were supplied with prisoner-of-war labour, and reserves were withdrawn from the army and sent to the grain fields. During the present summer the inactivity on the eastern front has enabled the German authorities to divert several million men to agricultural labour in Poland, Courland and Roumania.

But the sum total of these results has never reached the expectations of the authorities. The grain crops of '15, '16, and '17 did not equal the average of pre-war years. This is merely an expression of the fact that war reduces production. Despite efforts for the supply of fertilizer and labour and despite stimulation of prices, the withdrawal

of men from the rural population so lowered efficiency in agricultural operations as to make normal crop yields impossible, irrespective of climatic conditions. Women, children and old men, plus prisoners-of-war and soldiers for brief periods of time, deprived in large part of the work animals of the farm, do not constitute the equipment with which successful agricultural production is maintained.

Viewed from the statistical point of view, the range between successful and unsuccessful production in agriculture was not wide. Had Germany possessed large areas of unused land that could have been thrown open and operated by crop-tractor farming, an increased production of grain might have been accomplished; but Germany had a limited acreage in which grain could be sowed. From these limited acres she had secured large yields in peace time through intensive methods of agriculture. Under the stress of war time, the intensive methods could not be maintained, and the yields fell.

The highly specialized nation suffers in warfare more than the lowly specialized nation. A comparison between Germany and the United States is illuminating from this point of view. Artificial fertilizer was applied to every acre of grain field in Germany; in this country it is used to a very small percentage of the acreage. The lack of fertilizer in war time will not be felt here to anything like the ex-

tent it is felt in Germany. That which is true for grain is also true for other crops. Germany attempted to increase the yield of potatoes and to reduce the yield of sugar beets. Less sugar beets were required because the exportation of sugar was abolished. The acreage was cut down also on account of the large amount of labour required in cultivation. The acreage was therefore reduced one-fourth; but from this reduced acreage a normal crop has not been secured, and the result has been that Germany, a sugar-exporting country in time of peace, has in time of war been compelled to reduce the sugar ration of her people to practically one-half that of peace time. Potatoes return under highly specialized conditions of cultivation probably more in yield than any other human foodstuffs. Success in the raising of potatoes depends upon heavy fertilization, careful selection of seed and destruction of parasites, accompanied by favourable climatic conditions. The value of a crop of potatoes is also influenced by care in harvesting and housing. Germany had a record crop in 1915; the crop of 1916 was very low; the crop of 1917 is below normal.

Once the grain was harvested, Germany attempted to minimize its feeding to domesticated animals and its use in industry, in order that the grain might go to human utilization. The feeding of wheat and

rye to animals was strictly forbidden, but the edict could never be enforced. The use of barley in the manufacture of beer was limited, and the domesticated animals of Germany were rationed in barley and oats. The Germans established for their workhorses a scientific ration based upon minimum utilization of protein and maximum utilization of carbohydrate, and this led to the use of potatoes in the horse ration. The inability of the authorities to control the use of wheat and rye by the peasants was a source of bitter disappointment. It was well recognized that everywhere in the world the peasant has used his produce in accordance with his individual interests; but it was felt that in Germany, with military discipline and Teutonic patriotism, this would not be the case. It was therefore a sad revelation to the authorities, and above all to the social democrats, to find that the German peasant conducted himself as every peasant in the world has always done, from the standpoint of self-interest in the use of the produce of his soil and hands.

Germany's most severe blow under the blockade was the shutting out of imported concentrated feeding-stuffs. Germany used to import in the pre-war period over five million metric tons of concentrates, including in this term oil cake and meal, nut meal, grains, grain offal and tankage. In other words, Germany maintained live-stock in excess of the

ability of the land to produce feeding-stuffs for these animals. She preferred to maintain live-stock, import the feeding-stuffs and produce animal products in her own feeding-yards rather than import the finished meat products, as was done in large part in England. When the blockade was made effective Germany was unable to maintain her domesticated animals on account of the cutting off of the importation of feed. She thereupon decreed that the number of animals should be reduced to the scale of domestic-feeding-stuffs; one-third of the swine, all excess of adult cattle, and one-eighth of the milch cows were killed. It was the plan of the authorities to keep the count of live-stock down to the denominated figure. Had this been done, this number of cattle could have been maintained in good condition and with a fair return in production of dairy supplies. It involved of course the killing of young animals in the case of cattle and the limitation of breeding in the case of swine. Had the German peasant been convinced that the war would last into the fourth year, he might have followed this program; but he was not so convinced in the spring of 1915, when the slaughtering of cattle was ordered, and instead of keeping down the number of animals, they were secretly preserved, with the result that a year and a half later the count was practically back to normal. But inasmuch as the

corresponding feeding-stuffs had not been secured, the physical condition of the live-stock was low.

During the summer of 1917, the government has killed off a great deal of the accumulated stock, despite the poor physical condition of the animals, in order to supply an increased meat ration to make up for the extremely low bread ration. Today the total of live-stock in Germany is probably in the neighbourhood of two-thirds of that of the pre-war period; and the physical condition is such as to reduce its value to one-half. Should the breakdown of Russian military operations lead to an early peace, either actual or nominal, feeding-stuffs of all kinds, especially sunflower meal and grains, will be available in amounts that are practically unlimited, though it will require time for transportation to be so reorganized as to bring the supplies to Germany. The grain crops of 1917, including the yields in Courland, Poland, and Roumania, are in excess of those of 1916, and the next German stringency in food supplies will therefore not occur until March, 1918. The roughage crops are a failure, which means still further decrease in milk production.

It was extremely important to Germany to maintain the normal milk supply. The children's needs had to be met and large amounts were required for the army. Owing to the exclusion of foreign con-

centrated feed and the constant desire of the peasant to maintain his stock of milch cows, the total milk supply of Germany has fallen considerably below the normal. It is perhaps a fair statement to say that Germany has not had since the spring of 1915 over 60 per cent of the normal milk supply. This has been utilized to the best advantage. It has been so carefully conserved for children that the disturbances in nutrition in children that follow upon insufficiency of milk in the diet have not been observed. It has had, however, a serious result upon the German cuisine. It is impossible to prepare foods without milk or butter or other fat, and have them meet the normal taste of the Germans. When the German housewife no longer had milk for use in the kitchen and was denied the use of cooking fats, she stood helpless before the task of preparation of food; and throughout the last two years the German people have subsisted upon food that to their tastes was unnatural and definitely unsatisfying. That the milk ration to the children has been well maintained, despite the result of such conservation upon the diet of the adults, is a tribute to the discipline of the German people.

Viewing the matter by and large, is it clear that during the years 1915, 1916 and 1917 the production of food and feeding-stuffs in Germany was not over 75 or 80 per cent of the mean peace-time

production. In other words, the program of the German authorities for increased production failed; the normal production was not even maintained. If Germany continues to conquer territory to the east and appropriates the foodstuffs to herself rather than leaving them to the inhabitants of the conquered areas, she will be able to bring the production — viewed from the standpoint of what comes into Germany for the use of her own people — back to a point approaching the normal plane. But from the standpoint of production from her own acres, the program of stimulation has been a failure, a failure that was inherent in the situation of war and in no wise a reflection upon the efficiency of agricultural science.

Once the foodstuffs were produced, the German authorities attempted to secure an equitable distribution through the channels of trade, elimination of extortion, suppression of speculation and avoidance of waste. There is, under normal conditions, a certain differential between the sales price of the producer and the purchase price of the consumer. Whenever conditions in trade become abnormal, this differential tends to increase; the more abnormal the greater the differential. The net result of this operation of the laws of trade, plus the active self-interest of the trading classes, leads to

the situation that in times of greatest stringency the producer secures the least for his produce in comparison to its cost to the consumer.

The German authorities were determined that the differential between sales price to the producer and cost price to the consumer should, if possible, be maintained in war time at the peace-time level. They have been successful with certain commodities, unsuccessful with others. Their greatest success was attained with bread. Despite the fact that the price of grain was distinctly higher than the pre-war level, the cost of bread was maintained at practically the pre-war figure. The formula by which this was accomplished was one that has been worked out in Belgium by the American Relief Commission during the first year of the war, and runs to the effect that the price of bread per pound must not exceed the price of flour per pound. Now, since one pound of flour produces about one and one-third pounds of bread, the sole profit for the baker lay in this difference. A pound of grain under ordinary circumstances produces a little less than three quarters of a pound of flour, and since a pound of flour produces a pound and a third of bread it was approximately true to say that a pound of grain equals a pound of bread. Since the differential between grain and flour was relatively low

the end result was that the price of bread per pound to the consumer was practically the same as the price of grain per pound to the producer.

In order to maintain this situation, the German authorities were compelled to practise rather extensive dilution of flour. This dilution was of little importance so long as it was carried out by the use of other grains for mixing; but it became of nutritive importance when this was no longer done, and the stretching of the flour was carried out with potato. The mixing of potato with grain flour results in a distinct lowering in the nutritive qualities of the bread, since it amounted to little more than the addition of starch. When the German bread contained as much as 30 per cent of potato, it represented a reduction from the standpoint of protein of practically one-third. Nevertheless, when all is said and done, the fact that the German authorities have been able to maintain the pre-war price of bread represents an achievement of extreme importance from the standpoint of psychology and economics of the diet.

Whenever it became apparent to the authorities that it was not practicable with a commodity to keep the price to the producer and the purchase price to the consumer within speaking distance, so to speak, it could either allow the condition to remain as an irreparable situation, or cover the difference through

the appropriation of state funds. The latter plan was adopted in the case of the potato. The government fixed a sales price for the producer of potatoes, determined a fair price for the consumer and itself appropriated money to cover the difference. Sugar beets, under the complete control of the government, have been carefully conserved. The price of the beets was fixed. The differential to the refiners and the sales price to the consumer were fixed, and the difference between the price paid for beets and the retail price of sugar is not materially greater than that obtaining in peace time.

But, in the case of meats, dairy products, fruits and vegetables, the attempt to keep a normal distance between the producer's price and the consumer's price was a failure. In general, apart from sugar and wheat, maximum prices to the consumer have been a failure. Evasion was easy and constantly practised, the evasion taking the form of direct communication, outside of the state channels of trade, between the producer in the country and the consumer of means in the city. The maximum prices for the consumer applied only to the industrial workers in the large cities, in other words, to the Social Democrats, and this has resulted in a sentiment among the working classes of extreme embitterment towards the agrarians and also in a different attitude towards the war.

Apart from the achievements in price control and distribution, the German results in commercial control have been negligible. Extortion has not been prevented, speculation has not been checked, and distribution has not been equitable. In the case of bread and sugar success was obtained; in the case of all other commodities, failure resulted. When the data are carefully analysed, it is seen that the factor determining success or failure lay ultimately in the perishability of the product. Grain and sugar lend themselves to regulation. The perishability of dairy products, meats, fruits and vegetables lend themselves naturally to extortion, speculation and inequitable distribution. But they do not lend themselves to hoarding, whereas grain and sugar do lend themselves to hoarding; here the situation was reversed. The people of means could secure more than their share of dairy products, meats, fruits and vegetables through price manipulation and circumvention of the regulations that were impossible to the working classes. On the other hand, the classes of means could secure more than their legal share of flour and sugar because these could be hoarded, whereas hoarding was impossible to the poor because of lack of money. Under these circumstances, the natural trend of events worked to the advantage of the well-to-do classes and to the disadvantage of the poor. The most intense class

feeling arises from inequality in alimentation, since it represents inequality in the carrying of the burdens of the war. But it is a curious commentary upon the psychology of people that inequality in the direct load of military burdens is borne with apparent equanimity whereas inequality in the economic or nutritional burdens of war provokes intense class hatred.

The machinery for the control of distribution was both destructive and constructive — destructive in the sense that it involved wiping out middlemen, limitation in the number of wholesalers and retailers, and exclusion of all jobbers and commission merchants between the producer and the wholesaler and between the wholesaler and the retailer. As finally elaborated, the constructive machinery determines through what hands the foodstuffs produced in Germany pass, fixes the number of wholesalers and retailers, the prices that they are allowed to charge, the turn-over they are allowed for themselves, and for the consumer fixes the retailer from whom he is permitted to purchase. That this machinery involves a huge staff is obvious. It is, however, a striking commentary on the machinery of commercial distribution in peace time to state that a careful census in Germany has indicated that the official machinery for the control of distribution, plus the economic machine retained from the

pre-war period, represents only about one-half the number of individuals engaged in the pre-war period in the distribution of the same commodities. This experience of Germany has confirmed in a conclusive manner the contention of social thinkers to the effect that the trading class is over-populated, the articles passing from producer to the consumer through a number of unnecessary hands, a number not determined by exigencies in the trade, but solely by the profits to be derived therefrom. On the other hand it is apparent that the rigid reduction in the trading class is accompanied by a limitation of freedom to the producer and to the consumer that is keenly felt by both. There is less freedom to sell and to buy in Germany; with this loss of freedom, however, there is greater efficiency in the act of selling and buying. Whether a people in peace time would prefer to have a higher efficiency in selling and buying with less of individual freedom to buy and sell as one chooses, is an entirely different question.

It is also an interesting commentary on the psychology of a people to realize that despite patriotism and discipline, Germans of means never hesitated to circumvent the food laws in order to secure from the producing class foodstuffs whose sale was contrary to regulations. Despite constant appeal by the authorities that success in the war depended in

part upon the maintenance of the food regulations, producers were always willing to break them, and so were the consumers with means. This does not mean lack of patriotism. It means that individuals are not able to visualize the situation and do not believe that their offences against food regulations result in a lowering of the probability of success in military undertakings. The needs of the industrial relations of war as distinguished from the military operations lie outside of the power of visualization of the average individual. This is true in this country now and will continue to remain true as the war continues. Whosoever in war time demands "business as usual" is acting contrary to the forces operating for success in carrying on the war; and yet the very men who do so contend for "business as usual" in war time would not in the least hesitate to send their own sons to the front. They do not seem to realize that their behaviour in the conduct of their business increases the risk to the lives of their own enlisted sons. The cattle raiser who wishes to take advantage of high speculative price of livestock, the wheat grower who desires to obtain the profits to be derived from unrestricted competitive buying by the frenzied nations at war, the labourer who attempts to force the highest wage on the basis of supply and demand, and the coal operator who capitalizes the contest between in-

dustrial and fireside demands for coal, all fail to visualize the situation as it actually exists and do not realize that their point of view jeopardizes the successful carrying on of the war.

The German consumers, regarded as a unit, expected four things from the national food administration: 1, a ration adequate to their physiological and psychological needs; 2, a price for food-stuffs that would enable the wage to cover the cost of living; 3, equitable distribution throughout the different classes of society; and 4, guarantee of the ration allotment. The failure to succeed fully hinged entirely upon the failure to secure the third stipulation, that of equitable distribution. Had it been possible to divide in a strictly *pro rata* fashion the foodstuffs available within the German Empire, it would have been possible to supply to all an adequate ration at a bearable price and to have guaranteed it. But these three desiderata were not accomplished because the producer class, the agrarians (who comprise about 25,000,000 out of the total population) consumed more than their *pro rata* of foodstuffs, diverted a portion of the foodstuffs to the feeding of domesticated animals, and sold to the well-to-do classes in disregard of the regulations.

The brunt of the situation was borne by the industrial workers, a group that probably includes 20,000,000 people, and comprises in the political

sense the entire Social Democratic adherents, who were never able to secure the ration to which they were entitled. They did secure the ration of bread and sugar that was legally allotted to them; but the legal allowance of bread and sugar was less than should have been allotted on the basis of German production and itself represented a failure in the application of the principle of equitable distribution. Germany had bread grains enough to have guaranteed a flour ration of 300 grams per capita per day. When it came to the allocation of bread grains the situation was so manipulated as to make it appear that no such amount could be guaranteed. The first ration was fixed at 225 grams, later at 200, during a portion of the past year it was as low as 175, and is now to be restored to 220. A calculation of the officially reported grain crops of Germany on the basis of the established regulations for milling indicates that 200 grams of flour per capita per day did not exhaust the flour potentiality of the German grain; it could have furnished 300.

In the matter of price the Germans accomplished a repression of the prices of bread and sugar to those that approximated the conditions in peace time. The 1950-gram loaf of bread has sold at from 68 to 74 pfennigs. This is less than 5 cents a pound and represents a marked contrast to the price of bread in the United States. The price of

sugar has been held in the neighbourhood of 8 cents per pound, which approximates the price in this country. In no other direction has it been possible to hold the price down to the point demanded by the wage scale. Milk at 8 cents, the cheapest butter at 60 cents and the lowest-grade meats at 40 cents do not represent prices that lie within the purchasing power of the wage earner of Germany today, and there is absolute truth in the contention of the Social Democrats that the wage-earning classes of Germany during the past year and a half have lost in capital as a result of inability to meet the cost of living upon the scale of wages provided.

Since May, 1916, it has not been possible for the food administration of Germany to provide the 20,000,000 persons of the industrial class with a ration that can be regarded as adequate for the maintenance of health, body weight and the support of physical work. One of the three had to be sacrificed and the first to be sacrificed was body weight. The industrial classes of Germany, who have received not to exceed 2000 calories per capita per day for non-working individuals, have lost weight; they are trained down hard like athletes. There was no evidence in Germany up to March, 1917, that the health of these individuals had suffered; there was no increase of infectious disease and no ab-

normality in the death rate. No evidence has been adduced since that time to indicate that the health of the working classes has been undermined by their restricted diet. Indications are, however, appearing that the output of work is failing and this is the natural sequence of events since weight is first lost, then work is reduced, and finally health impaired as the diet is progressively lowered. The Germans have paid particular attention to the alimentation of their children. They have not been sacrificed to any demonstrable extent; and indeed the almost total withdrawal of milk from the diet of adults and in the preparation of food in order that it might be conserved for children represents an illustration of the far-sighted policy that was adopted. That the restrictions in the diet during the past year and a half have fallen almost entirely upon the industrial workers of the cities is fully realized by the industrial classes and represents a *casus belli* between them and the agrarians that will be the occasion of bitter political contests after the war. The harsh treatment inflicted by the peasants during the past summer upon city children sent to the country for recuperation has only intensified this bitterness.

How long the German industrial classes can hold out on the present diet cannot be stated. The writers do not believe that it could ever be possible to

starve out Germany, even if she were shut within her own borders, except in the event of unusual crop failure. The purpose of the food blockade is not to starve Germany but to compel her to produce all of her foodstuffs, and thus have to withdraw labour, capital and organization from industrial lines directly contributing to the war. There is evidence that the crops of Germany and Austria-Hungary, including those of Courland, Poland, Roumania and Servia, will this year enable considerably larger rations to be allotted to the working people. To what extent the increments, largely in grain, will be counterbalanced by sharper application of the blockade and reduction of importations into Germany from surrounding countries remains to be seen.

The German government failed to guarantee any ration except the bread ration and the milk ration for children under the sixth year of life. Otherwise, it was in large part "first come, first served" during the first year and a half of the war; and since that time the authorities have made pro rata reductions from the stated ration in the event of stringency of the supply. It was not always possible to allot a pound of sugar a month. Even the bread ration was at times impossible of fulfilment, but this was countered through substitution, more potato being issued. The attempt was always made to secure in substitution an equal value in terms of nu-

tritional units, though naturally when potato was substituted for bread, the ration was lower in protein. In connection with fat, it has been particularly difficult to guarantee the ration and this has led to progressive reduction so that for months at a time the fat ration issued in many German cities has been as low as two ounces per capita per week, and rarely over three ounces. The allotted ration of fruit and vegetables represented little more than privilege of purchase if it could be secured.

Waste in foodstuffs occurs throughout the entire chain of transfers from the original producer to the final consumer. For certain commodities the waste in the hands of the producer is high, in the hands of the consumer low. For other commodities, the waste is low with the producer and high with the consumer. In some of the commodities the chief waste lies in distribution. Everywhere in the conservation of food supplies, the problem of waste must receive the most critical attention; and extreme and persistent efforts are required to eliminate waste through education of the producer, the trade and the consumer in methods of conservation.

Along these lines the Germans have achieved a most signal success during the war. Indeed, a careful survey made in Germany during the summer of 1916 indicated that, apart from certain untoward happenings — which might really be called accidents

in distribution — waste in foodstuffs in Germany had been almost eliminated. There is good evidence that waste in the large sense of the word included an almost unbelievable fraction in peace time. For example, according to the official German statement of their food resources, there was provided in Germany in the pre-war period food for each individual per day to the amount of some 3600 calories. It was the judgment of German scientists that not to exceed a per capita of 2800 calories at the outside was actually consumed, leaving a waste of 800 calories, or practically 22 per cent of the food provided.

A survey of the food resources of this country indicates that a similar waste occurs in this country. One of the curious things about this fraction of waste is its apparent immutability with a people except under conditions of such stress as to call forth systematized organization for conservation. If in a particular country the food resources provide a per capita food supply of 3600 calories and the food consumption is 2800 calories, leaving a waste of 800 calories, one might imagine at first sight that if the food resources were to fall to 3500 calories, the consumption would be maintained at 2800 and the waste reduced to 700 calories. This, however, does not occur at first; instead, if the food provided is reduced from 3600 to 3500 calor-

ies, it will be found that the consumption will be reduced from 2800 to 2700 calories, and the waste maintained. In other words, our habits of consumption are more flexible and adaptable than our habits of waste; and it is only when systematized education in the direction of conservation and the elimination of waste is carried on that the people as a unit so act as to have the reduction in food provided fall upon the waste rather than upon the consumption.

When it is recalled that, in accordance with trade figures, the food provided in Germany in the pre-war period offered some 3600 calories and that the per capita consumption (on the basis of the non-working individual) in German industrial cities has for over a year been in the neighbourhood of 2000, one realizes clearly that the largest fraction of this reduction has been obtained, not through reduction of food consumption but through reduction in waste. One of the difficulties in the estimation of the degree of reduction that a people can endure in food supply lies in our inability to separate the factors of restriction in the diet from elimination of waste. It has been a common statement of students of nutrition that the diet of a people cannot be reduced 25 per cent from the customary plane without influence upon health. The German experience indicates that this is not true. It is prob-

ably true that a diet cannot be reduced over 25 per cent from the figure of actual ingestion; but this does not mean that the food of a people as provided in initial production cannot be reduced over 25 per cent, because a large portion of this reduction may fall upon waste. It is probable that the food consumption in the home of the French peasant represents the maximum of efficiency, that is, there is the least waste; but even in France, as a nation, the food supply at present is, from the standpoint of total units and taking into consideration the increased physical labours of war, 20 or 25 per cent below that of the pre-war period. It is necessary that the general public should differentiate clearly between repression of consumption and repression of waste, though in the tabular sense they appear in the same columns. From the practical point of view, the more successful the elimination of waste, the less necessary the repression of consumption; and indeed excessive consumption beyond the needs of the body represents as definite and indefensible a form of waste as the actual throwing away of food into garbage.

There is a reverse side to the psychology of a campaign against waste that deserves a momentary consideration. Every duty imposed upon civilians in a period of such unprecedented stress as the present is liable to provoke a reflex reaction of aversion.

The pressure now being applied in the European household to eliminate waste is intense. The discipline has become so irksome, its minutiae so irritating, that the women of Germany — as one clear-visioned woman said to the writer — long for the day when wasting will be again permitted. In particular is this true of the working classes. It is the working classes who know how to conserve against waste in times of peace. Of the waste in American homes, three-fourths occurs in one-fourth of the homes. From the standpoint of nutritional values, in a campaign of education against waste the greatest success is achieved in homes where there is the least waste, because here the financial pressure is greatest. Under these circumstances, care must be exercised in not forcing home a campaign against waste with such irksomeness in minutiae as to bear too heavily upon the poorest classes and provoke a psychological revolt.

All in all the nutrition of the individual classes in Germany during the last year and a half has been a revelation to the scientific world, even without considering the question as to the ultimate results of such a reduction in the diet. The industrial classes of Germany have demonstrated that millions of hard working men and women can subsist and work in apparent good health, though reduced in weight, upon two-thirds of the diet previously re-

garded as a minimum. Curiously enough, in the controversies that have been waged for years over the minimum in nutrition, the German scientists have usually stood out for high values, and it has thus been their lot to observe in their own country the contradiction of their theories through the successful demonstration of the adequacy of the low intakes that were long contended for by physiologists outside of Germany and especially in the United States.

Viewed as a whole, the rationing system of Germany cannot be regarded as having been more than a partial success. Such success as it has attained has been due to the highly organized discipline and minute administrative control characteristic of the German people and their government. At the same time some of the failures were due to the very same qualities, especially to the administrative detail. There is no question that the rationing of the German people has been less successfully accomplished than the rationing of the Belgian people under the Commission for Relief in Belgium. The difference may be attributed largely to the superiority of a system of decentralization, aiming at 80 per cent efficiency, operating through the principle of centralized control, aiming at 95 per cent efficiency. Maximum prices for the consumer have proved for the most part a failure. Guarantee of ration has

been for the most part a failure. The substitutions have been in part a success from the nutritional point of view, but cannot be regarded as a success from the point of view of the tastes of the industrial classes concerned. Certainly if a rationing system cannot succeed in Germany it cannot hope to succeed anywhere.

PART II
THE TECHNOLOGY OF FOOD USE

CHAPTER V

THE PHYSIOLOGY OF NUTRITION

IN the contemplation of a diet four factors must be taken into consideration, two intrinsic and two extrinsic. The two intrinsic factors are determined by the physiology of nutrition and the psychology of alimentation. The external factors are the supply of foodstuffs and the influence of trade. Under ordinary conditions in the life of a nation, with certain commodities the factors of supply and trade have as much influence on the selection of a diet as the factors of nutrition and psychology. At first sight it might appear that the factor of supply must necessarily predominate over the influence of trade, and this is of course true in the final analysis; but with a supply that is to be regarded as normal and sufficient, influence of trade operates so as to place certain foods in positions of predominance and others in positions of subordination that do not at all correspond to the essential values.

The influence of trade is a composite. It includes elements of production (including fertilizer, cost of labour, price of machinery, transportation and

climatic conditions); nationalities of consumers in different zones; trade policies; the influence of advertising and publicity; artificial manipulation of markets, beginning with the primary market and extending through the entire chain of distribution to the consumer; and includes finally a factor that may be termed "the psychology of trade," a definite tendency of commodities to move in certain directions that is not fully capable of analysis on the basis of known economic and commercial relations, but which is, in the final estimation, probably an expression of the efficiency of particular individuals.

In the diet of a people, all of these factors play a rôle in times of peace and prosperity. The greater the prosperity and the freer the choice of individual action, the less influential is the factor of the physiological nutrition of the body. With complete freedom of choice, divested of the influence of the four factors described, wide scope is afforded for the personal variable that extends from individualism to idiosyncrasy, an expression of the democratic viewpoint in relation to the personal habits of the individual.

Under conditions of stress the factors of physiology of nutrition and supply of foodstuffs assume more and more predominance over the factors of influence of trade and psychology of the diet. Efforts to influence the consumption of foodstuffs by

a people lie in the direction of giving greater predominance to the facts of nutrition from the purely physiological standpoint, under the existing conditions of supply. Uncontrolled, this is liable to result in harsh repression of the psychology of the diet on the one hand and in reckless elimination of the influence of trade on the other. Particularly the exclusion of the psychological relations of the diet is a mistake easily accomplished but difficult of repairment. The ideal adjustment is a composite of all factors; for a people as a whole it is better to secure a moderate degree of efficiency in the balancing of all factors than to secure a high degree of efficiency in one group, as that of physiological alimentation, viewed as animal nutrition.

In order that the average individual possessed of a general education and the cultured viewpoint of American citizenship, but devoid of technical training, may be able to understand the subject of nutrition from the standpoint of the four named factors, it is necessary that the principal facts known to hold in the nutrition of the animal body be understood.

From the standpoint of nutrition the body is a machine — a complicated machine — and, of course, something more than a machine. Viewed from the standpoint of energy relations (that is, the production of heat and the conversion of energy into work) the animal body presents a strict analogy to a ma-

chine. With a well-designed motor, one may perform work involving the use of gasoline possessing one hundred units of heat, as determined by analysis and measurement of the heat. In the working of this motor, it will be found on measurement that from 25 to 30 per cent of the energy of the fuel, according to circumstances in the design of the motor, will be converted into work; the remainder will be converted into heat and dissipated as such. When a labourer performs a similar act of work, it will be found that fuel has been burned in an entirely analogous manner, and that of the energy contained in the fuel consumed, between 25 and 30 per cent will be converted into work and the balance converted into heat and dissipated. The percentage of fuel converted as work is termed the mechanical efficiency of the machine, and the efficiency of a soldier on the march is about the same as that of the engine of the truck that is hauling the ammunition. When the man becomes tired his efficiency falls; when the engine departs from accurate adjustment, its efficiency falls. If for any reason in internal economy the burning of food-stuffs in the body is imperfect, as is the case in certain diseases, then the efficiency falls; if in the adjustment of the carburetor the burning of the gasoline is imperfect, the efficiency of the motor falls.

Viewed more closely, the animal body presents

striking differences from even the perfect machine. The machine must be repaired; the animal body is self-repairing. The machine must be lubricated in addition to having fuel supply; the animal body is self-lubricating in the sense that what might be compared to the lubricants of the machine are produced within the body. Lubrication, upkeep and replacement are all external in the motor, internal in the body. A machine must be built by external hands; the animal body possesses the power of multiplication of the species. The human body possesses finally the power of self-direction of its operations; the machine lacks entirely the power of self-direction except such as may be mechanically introduced and maintained.

A clear distinction must be made between the energy equivalents of heat and muscular work on the one hand and of other physiological functions and mental operations on the other hand. A man lying in perfect quiet, performing mental operations of prodigious intensity, will produce no more body heat, according to our present methods of measurement, than if his mind were not engaged. The movement of a nerve impulse down a nerve can be shown by extremely minute methods of measurement to be accompanied by evolution of heat; but applied to an entire body the amount of heat that must accompany mental operations is so small as to

fall within the range of error of measurement of heat involved in the maintenance of the body temperature. Practically, therefore, fuel is not required for mental work; and no more foodstuffs are required for a sedentary man engaged in mental operations than in idleness.

A number of other physiological functions, such as the influence of the ductless glands and the operation of the special senses, possess heat relations so minimal as to be of no importance when considered from the standpoint of the food requirements of the body. Therefore, for practical purposes we may say that the fuel needs of the body are represented solely by two requirements; requirement for heat to maintain the body temperature of the resting body and the requirement of energy for the maintenance of the muscular work of respiration, circulation, alimentation, and physical exertion. It is convenient to separate rather arbitrarily the factors of heat production and muscular work from those of repair and upkeep of the adult body and growth of the young body, both in the qualitative and quantitative sense.

The factors involved in these various relations of nutrition may be classified under six headings to which must be added two that are of importance in the act of digestion and therefore secondarily of importance to the state of nutrition. The first six

are protein, fat, carbohydrate, mineral salts, vitamins, and water; the two alimentary factors are bacteria and indigestible residue of the diet.

PROTEIN

Under the term protein we understand all substances allied to what is commonly termed albumin, — as the casein of milk, the white of egg, the plasma of muscles, gelatine, and the serum of blood. Protein is the substance of which flesh is primarily composed. Blood contains about 8 per cent of protein; the white of egg about 12 per cent; lean meat about 20 per cent; the common grains about 10 per cent; milk a little over 3 per cent; some of the beans as high as 30 per cent; potatoes a little over 1 per cent, etc. All living organisms, plant or animal, are, in the final analysis, composed of cells and structures derived from cells. The essential component of the cell is termed protoplasm and the chief constituent of protoplasm is protein.

Protein is not a unit substance. There are many kinds of protein and the variations are due to differences in composition. Proteins are organic substances of so large a molecular size that the individual molecules can be seen under a microscope when viewed with oblique illumination. Proteins are composed of aggregations of simpler substances known as amino-acids. About 20 amino-acids are

known and the different proteins contain variable numbers of these. It is the variation in components and in the amount of the several components that causes the physical and chemical differences in proteins. All proteins are, in their final analysis, of vegetable derivation; and animal proteins represent transfers to the animal body of amino-acids created in plant life. One gram of protein yields to the body 4.2 calories of heat.

The structure of proteins may be compared to the architecture of a house. A house contains brick, stone, concrete, plaster, glass, floors, roofing, doors, windows, iron pipes, etc. An architect could construct out of the same materials in the same amounts houses that would present entirely different external and internal appearances; and in a similar way proteins exist, consisting of the identical amino-acids in practically identical proportions, that have different chemical and physical properties depending upon the architecture, that is, the manner in which the different amino-acids are built together. It has thus become a common expression to term the amino-acids the "building stones of protein."

Now the animal body must receive in the diet the amino-acids from which it builds its own proteins. Certain amino-acids can be formed in the body, but other amino-acids cannot be formed in the body and the diet must contain them. These amino-acids

we speak of as the indispensable amino-acids. When a protein contains all of the amino-acids or contains the indispensable ones and the others in such amounts as to enable the body to fill its requirements, we speak of this as a complete or balanced protein. If, however, the protein is deficient in certain of the essential amino-acids or contains a large preponderance of some one of the other amino-acids, we speak of the protein as incomplete or unbalanced. The balanced protein is able to fulfil all of the protein requirements of an animal body; the unbalanced protein is not. When an animal is fed a diet of unbalanced protein, growth cannot be maintained and if the defect be serious enough, the animal will waste.

The amount of protein required in the diet depends upon two variables: (1) Upon the intensity of wear and tear and upkeep in the particular animal concerned; and (2) upon the nature of the proteins of the diet, whether balanced or unbalanced. With a particular animal, if the diet contains balanced proteins a much smaller amount will be required than if the diet contained only unbalanced proteins. In general, less protein of animal origin is required to maintain equilibrium than with the use of plant protein.

Assuming that the proteins in the diet are balanced or within the range of adaptation, the amount

of protein required in the animal body is surprisingly small. Growth consists of dimensional and numerical increase. Certain cells, like the cells in the blood and the lining cells of the skin and mucous membranes, have a limited span of life; they die and must be replaced. Other cells, however, endure for the entire life of the individual. The number of cells in the biceps muscle of the newborn child is the same as will be present when that child has developed to maturity; the growth consists entirely in increase in the dimensions of the cells. Now the requirements of growth for a day are so small that they scarcely appear in comparison to the wear and tear needs of the day. In practical dietetics, a growing child of a certain weight requires very little more protein than an adult of that same weight. The chief concern in the diet of a growing child is not the amount of protein, but the presence of balanced protein. While the total amount of protein per unit of weight is very little less in the growing child than in the adult, the amount of essential amino-acids is distinctly larger. For this reason it is particularly important in the diet of the child to secure a large percentage of the intake of protein in the form of balanced protein, namely, that of milk. It is a safe rule that 40 per cent of the protein of the diet of growing children should be balanced protein obtained from animal

products. In the case of the adult, this may safely fall to less than 20 per cent.

This does not mean that vegetarianism in the strict sense is impossible. It is possible, but it is difficult. A person having at his disposal a wide variety of cereals and plants for selection could obtain a diet balanced in protein, although the amount of protein eaten to insure this would have to be larger than when animal products are used. Vegetarianism is much more difficult with the child than with the adult. It is difficult, although possible, to raise a child without milk, eggs, or meat; it is not in the least difficult, under conditions of modern markets, for an adult to practise strict vegetarianism with success. It will mean a large and bulky diet, and probably an expensive diet; but the balanced protein can be secured for the adult without much difficulty.

If the proteins be balanced a gram of protein a day per kilo weight is more than sufficient to cover all of the needs of the body, the wear and tear and upkeep. It is also sufficient to cover the needs of growth in the young. The mother's milk contains less than 10 per cent of its energy in the form of protein, but it maintains the highest intensity of growth in the life of the individual. Obviously, the amount of protein, if balanced, contained in mother's milk, would be sufficient for any later period.

Under upkeep and wear and tear we understand that cells in the act of functioning, like machinery in operation, undergo breakdowns. There must be replacements within cells; just as a particular piece of a gasoline motor, like a piston ring, may break and have to be replaced, so a small portion of living cells disintegrates and must be replaced. This wear and tear and upkeep is the largest fraction of the protein turn-over of the body.

If more protein is ingested than is required to maintain growth, wear and tear and upkeep, it is destroyed in the body. The body does not store in the sense that the body stores fat. No matter how great the excess of protein beyond the needs of the body, the needless protein is destroyed and end-products appear in the urine. Now, since protein is an expensive form of food to produce in nature and, therefore, expensive in the market, we ought to reduce the ingestion of protein to somewhere near the point of need. Protein consumed in excess of the tissue needs becomes a mere fuel, but a very expensive form of fuel and one that possesses in addition a residue to be eliminated in the urine. The difference between sugar and protein as fuel may be compared to the difference between crude oil and coal. Sugar burns completely and leaves no ash; protein burns incompletely and leaves an ash and this ash must be eliminated, imposing

upon the kidneys a useless labour, comparable to removing ashes from a grate. Certainly no engineer would use a coal with ashes if he could for the same price or a smaller price use an ashless fuel; and whenever protein is consumed in excess of the tissue needs, it amounts to selecting deliberately a fuel with a large ash instead of a fuel with no ash.

The consumption of protein is high in new countries where there is a large amount of land per capita, with many head of live stock per capita; it is low in countries of congested population where the per capita of domesticated animals is low. The consumption of protein is high with people of means and low in a nation of poverty. Thus the highest consumption of protein is seen in Australia and New Zealand; the lowest consumption is seen in India, Japan, and China. The consumption in the United States and England is high, as an expression of wealth. The consumption of protein in the form of meat varies largely in different nations; the ingestion of plant protein does not vary so widely.

Intense controversy has occurred during recent years as to whether meat possesses in the diet properties that are not yet measurable on the basis of either analysis or experience. It is contended that the strength and virility, in the physical and intel-

lectual senses, that together constitute the forces of civilization as seen in the Anglo-Saxon race, as distinguished from the Chinese or East Indian, are due to the greater consumption of meat. This argument is not valid. The consumption of meat is much higher in Australia and New Zealand than in England. The consumption of meat in this country was much higher 40 years ago than it has been in France for a long time — as long, indeed, as records exist there. Now, no one will contend that Americans possess attributes in any direction not possessed by the French that can be reasonably ascribed to our greater ingestion of meat. When one compares a sallow, anaemic East Indian with a rugged Englishman it is easy to be led astray and to ascribe the difference to the meat in the diet of the Englishman as against the cereal in the diet of the East Indian; but there are so many factors to be taken into account that no such conclusion is warranted. There are vegetarian peoples who are as rugged in comparison to the East Indian as is the Englishman. The Englishman is free of intestinal parasites, whereas practically all East Indians harbour one or many varieties of intestinal parasites. The hookworm campaign in our country has afforded to our people an illustration of the veritable transformation to be accomplished in a people without change of diet, simply by removal

of intestinal parasites. The diet of the East Indian is not merely a vegetable diet; it is a poor vegetable diet. For the growing child there is no question that protein of animal origin is very desirable and, indeed, from a practical point of view in the dieting of communities, indispensable; but after the fraction of protein known to be essential — for the adult, 20 per cent of one gram daily per kilo body weight — has been covered by the ingestion of protein of animal origin, it is immaterial with what protein the balance of the intake is covered, and there is no gain in an ingestion of protein in excess of the denominated amount. The average ingestion in America is at least 50 per cent in excess of need.

FAT

A certain amount of native fat is required in the diet. Fat exists in the protoplasm of every cell. The body forms fat from sugar easily; therefore, the necessary factor in native fat is not the chemical substance, fat. If the fat intake falls below a certain figure, especially with the child, disturbances of nutrition ensue. Now the amount of fat concerned is so small that the body could easily secure this amount from sugar. In this fat intake are two factors: one relating to the essential processes of growth, the other relating to less essential

relations in a diet. One gram of fat yields to the body 9.3 calories of heat.

A diet low in fat does not lend itself to our normal types of cooking. Foods prepared without fat are not naturally cooked and do not suit the taste. A diet low in fat is rapidly digested and inasmuch as the sense of satiation in alimentation is in part connected with the duration of the process of digestion, fat-free foods do not give the normal satisfaction. These two factors, the use of fat in cooked food and the acceleration of the process of digestion in the absence of fat, account for the dissatisfaction felt in Germany at present with the low fat intake. This is in part a matter of habit; the low fat intake in Germany today is as high as the normal fat intake, weight for weight, in Japan. Indigestion may ensue in any individual who continuously follows a diet that does not give digestive and physiological satisfaction.

Native fats of animal origin contain a special substance indispensable for growth. This is a fat-soluble vitamine and will be described with water-soluble vitamines under the discussion of these interesting bodies.

The desirable fat content of the diet of an adult may be stated to be not below 40 grams per day, but many individuals will find 50 or 60 grams much more compatible with their tastes. For the gen-

eral uses of fat in the preparation of food one fat is as good as another; vegetable fats are just as good as animal fats — oleomargarine, cottonseed oil, olive oil, corn oil, peanut oil just as good as butter, lard, tallow, or suet. The use of fats in the diet for the preparation of food is a matter of culinary art. For our entire population, daily ingestion of 50 grams of fat could not fail to satisfy the most extreme tastes. In the case of the child, the vegetable fats cannot be compared to the animal fats, especially to butter fat. Butter fat, in other words milk, contains a high concentration of the indispensable vitamine of growth, and for this reason in growing children a certain amount of the fat taken ought always to be milk fat. If the amount of milk that furnishes the balanced protein be present in the diet of the child, we may be sure that the essential amount of growth-producing substance is also present. The claims of one reinforce the claims of the other and make it a public duty to secure for every child in the slums of our cities that amount of milk daily that is necessary to maintain the normal processes of growth and development.

When the child is weaned it is transferred to cow's milk, which for a time takes over the entire sustenance of the child. As the child grows older and other foods are added, the relative amount of its food derived from the daily milk falls gradually.

With the poor in our city slums children frequently are denied milk after the fifth year; with the classes of better means, milk is continued in the diet of the child until adolescence. With a well-selected diet, such as is possible to people of means, it is less necessary to continue milk in the diet up to the time of adolescence; but with the people of poorer means, where a proper diet is rarely selected, it is very important to continue the use of milk in the diet of the child as long as possible. For this reason, the maintenance of an adequate milk supply for cities at as low a price as possible becomes a matter of much more than mere nutritional importance.

CARBOHYDRATE

Under the head of carbohydrate are included all of the starches of cereals, tubers and vegetables of all kinds and the sugars. These carbohydrates all have the same ultimate meaning in nutrition, since in the act of digestion and resorption they are all converted into one chemical state, glucose. Carbohydrate is not absolutely necessary in the diet. Eskimos and other flesh-eating tribes subsist for years on animal products. Nevertheless the body requires a certain amount of sugar, since sugar is an essential component of cells and the circulating fluids of the body contain a quite constant percentage of sugar. When protein is utilized a certain

amount of sugar is formed, and when an individual subsists entirely upon meat and fat the sugar derived from the meat is sufficient to supply the body with the sugar that is required. The need of carbohydrate, in excess of the small amounts required by the cells, is as a fuel; and carbohydrate occupies its predominant position in the diet because it is the cheapest fuel. As a fuel sugar is more quickly utilized than fat. When the body has available for use both sugar and fat, and physical work is undertaken, the body always burns sugar first; it is only when the stores of sugar in the body have become depleted that the body burns fat to maintain work. We therefore speak of sugar as the primary fuel and fat as the secondary fuel, though they are entirely interchangeable; and in practical experience it is largely immaterial whether one supports body work and body heat by combustion of sugar or fat; it is a question of taste and economics. One gram of carbohydrate yields to the body 4 calories of heat.

The amount of carbohydrate required in the diet depends therefore upon climate and upon physical work. Given an adult resting man of 70 kilos body weight, the amount of protein required as previously stated may be set at 70 grams, equal to 300 calories—a food calorie is that amount of food which will produce heat enough to raise one litre of water one degree centigrade. The amount

of fat required for the maintenance of normal nutrition may be set at 40 grams, equal to 370 calories. The individual of 70 kilos, resting, fasting, in a room at tropical temperature, will produce let us say 1750 calories. Subtracting from this the sum of the heat values of protein and fat, will leave 1080 calories to be covered by carbohydrate, if the cheapest fuel is to be used, equal to 270 grams. One could maintain the body heat of this individual by the ingestion of a corresponding amount of fat (which would be 115 grams), or also by the ingestion of 270 grams of protein. A sedentary life requires 100 to possibly 200 additional grams of carbohydrate; active work, 400 or 500; hard work, up to or even exceeding 1000 grams. In actual practice, men who work hard do not cover all of their fuel needs with carbohydrate; they use both carbohydrate and fat in order to reduce the bulk of the diet. Sugar is a particularly available fuel for hard work; direct experiments indicate that sugar introduced into a working individual will be utilized in as short a time as fifteen minutes. The heat production of the new born babe is about 600 calories per day, that of the sedentary man about 2500, and the figure rises with physical work to as high as five thousand or more calories. The ration of our army provides 4400 calories. The heat production of women is less than that of men. The

per capita food need in terms of calories is between seventy-five and eighty per cent of the food need of the average adult male.

Now in the use of food in actual life we do not find protein, fats and carbohydrate separately, but find them commingled in different proportions in different foods. Thus, the cereals contain on an average of 70 per cent of carbohydrate and 10 per cent of protein. Milk contains all three; meat contains protein and fat; and many of the legumes, such as the soya bean, contain large amounts of protein, fat and carbohydrate. The green vegetables are poor in all, containing most carbohydrate and very little fat. With the diet so arranged as to contain the needed amounts of animal products in order to secure balanced protein and the fat-soluble vitamine, experience indicates that if the diet contains enough energy units to support the individual, it contains enough protein and fat to meet the needs of the body. One does not need to be concerned about the protein intake in a normal mixed diet, since it is practically impossible to secure the amount of carbohydrate necessary to maintain the work of the individual without at the same time securing the protein; and the same statement holds for fat. It is only when individuals in poor circumstances, in attempting to reduce the cost of living to the lowest level, subsist upon very

one-sided diets, consisting of few articles to the practical exclusion of animal products, that abnormalities in nutrition occur. A diet of potatoes alone has maintained individuals in apparent health over a period of several years. One can live on mixed cereals alone so far as protein, fat and carbohydrate are concerned. From the economic point of view it is important to calculate the components of a ration from the standpoint of protein, fat and carbohydrate; but from the nutritional point of view, this is less important in the normal mixed diet in a civilized community.

MINERAL SALTS

The body requires mineral salts for the skeleton and for the maintenance of the normal physical state of the body cells and circulating fluids. The chlorides, phosphates and carbonates of lime, sodium, potassium, calcium, magnesium and iron are the bodies most largely concerned. These mineral matters are obtained in the diet in cereals, fruits and vegetables. In a normal mixed diet it is rare to secure a deficiency in salts; it is only when the diet is extremely one-sided or repressed that a deficiency in mineral matters appears. This deficiency in mineral intake is more important in childhood than in adult life. A safeguard here lies in the abundant use of milk, which contains all of

the mineral matters needed for the body. A diet consisting of white patent flour alone would not contain the necessary mineral matters; a diet consisting of potato alone would contain the necessary mineral matters. The addition of fats to white patent flour would not furnish the necessary mineral matters. Much more mineral matter is contained in grain offal than in patent flour. Individuals who prefer bread made of patent flour must, therefore, secure their mineral salts from fruits and vegetables, and this is entirely practicable. If, however, it is not possible to secure fruits and vegetables, then the diet must contain flour made of the whole grain in order to obtain the necessary mineral matters.

VITAMINES

Under vitamins, we understand two kinds of substances whose presence in the body is essential to normal health and growth. These vitamins are designated in accordance with one of their pronounced properties, namely, that of solution, as water-soluble vitamine and fat-soluble vitamine.

The water-soluble vitamine is present in cereals, fruits, vegetables, meats, and in milk. If food-stuffs are consumed in a natural state, the water-soluble vitamine is abundantly available. It is, however, destroyed by prolonged heating and therefore in the preparation of foods some of the water-

soluble vitamine may be destroyed. The cereals contain the water-soluble vitamine in the outer layers, and it is, therefore, not present in patent flour, but is present in whole wheat flour. The vitamine of the cereals is not destroyed by the amount of heat used in the ordinary act of baking. On the other hand, the vitamines in vegetables may be destroyed in the ordinary act of canning where the heating is severe. Therefore, an individual subsisting upon bread made of a patent flour and canned vegetables and canned meat would be apt to exhibit after a length of time nutritional disturbances related to the absence of water-soluble vitamine. In the Orient, a diet of polished rice and fish leads to the disease termed "beri-beri," which is cured by the administration of fruits, vegetables, or by the consumption of unpolished rice. A diet composed predominatingly of patent white flour and lard or other pork products is apt to lead to nutritional diseases, such as have been observed in Labrador; and it seems probable that pellagra is due largely to the absence of water-soluble vitamine. It is a common misconception that these vitamines reside only in the outer hull of grains and that, therefore, all individuals should use whole wheat flour. This is incorrect, for fruits and vegetables are, as already stated, rich in these vitamines.

The fat-soluble vitamine is not present in the cereals to any material extent. It is present in leaves and in many roots. If animals be fed wholly upon cereals they will exhibit after a space of time nutritional disturbances. If the diet contains leaves and roots, such disturbances will not appear. A balanced ration for domesticated animals consists therefore of cereals and leaves or roots. Now when these leaves and roots are consumed by animals, the fat-soluble vitamine passes into the tissues of the animal and passes also into the milk. The fat-soluble vitamine is present in milk to a higher concentration than in any other foodstuff. It is this that gives to milk its predominant influence over the process of growth, since absence of fat-soluble vitamine shows its most pronounced effect in cessation of growth. Since children cannot digest such leaves and roots, it is imperative that vitamine be offered to them in the form of milk. It is of importance to insist that the fat-soluble vitamine is not present in whole grains and is therefore not present in whole wheat bread. It is also important to know that fat-soluble vitamine is for us much more important than the water-soluble vitamine. The water-soluble vitamine is practically everywhere; but the fat-soluble vitamine is largely localized in a few food-stuffs, and these must be present in the diet in the

proper amounts. It is especially important that the diet of the woman in gestation should contain an abundance of fat-soluble vitamine in the form of milk or leaf vegetables.

WATER

No discussion of the need of water in the body is necessary beyond the mere statement that water is required in the act of digestion; that a certain water concentration is essential to the life of the cells; that water must be provided for renal elimination; and that the need for water depends beyond this upon the necessary elimination of water in the maintenance of body heat through the respiratory and cutaneous systems. There are many fads connected with the drinking of water. There is a common notion that water taken with meals is injurious. If mastication of the food be carefully carried out and water be consumed between the swallowing of food, the consumption of a moderate amount of water is advantageous. The idea that water with meals is conducive to obesity is only true if the use of the water is conducive to the ingestion of excessive amounts of food.

The normal diet should contain an indigestible residue in order to furnish a normal bulk to the stools. This is not a statement of animal physiology; it is a statement of the physiology of the

civilized individual. Experimental investigations in animals and X-ray observations on human beings indicate that the alimentary tract of the child normally reacts with an evacuation of the bowels following each ingestion of food. This is seen in the babe and would appear throughout normal life if it were not trained out of the individual in order to have his habits conform to the conventions of civilized existence. Investigations among savages in various sections of the world have indicated that savages evacuate the bowels after every act of eating, and there are in civilized communities considerable numbers of individuals who have retained or re-acquired the normal muscular habits of the primitive alimentary tract. With most individuals, however, the muscular tone of the intestine loses its normal response and depends for its reaction to a certain extent upon the mass of the intestinal content. The mass of the stools consists of the secretions of the alimentary tract, the unresorbed foodstuff that was digestible but not resorbed, and the indigestible components of the foodstuffs. Fruits and vegetables leave a large residue. The residue of cereals is heavy if the whole grain is consumed. The residue of meats, dairy products, patent flours and vegetable oils is very small since their digestion is practically complete and they contain little indigestible residue. It is quite imma-

terial from what the indigestible residue is derived, whether from fruits, vegetables or the hulls of grains. This is a question of individual taste and of the reaction of the individual alimentary tract.

PSYCHOLOGY OF THE DIET

These factors described compose the physiology of digestion. They comprise the known facts of digestion in animals that hold for human beings so long as the human being can be compelled to act like an animal. They will hold strictly for savage tribes who have a physiology, but little psychology, of nutrition. As one ascends in the scale of civilization, the laws of the physiology of nutrition do not lose their validity, but the psychology of nutrition assumes constantly greater importance until finally, with the average individual of our day and country, the psychology of the diet, from the standpoint of the individual and of the community, is as important as the physiology of nutrition. It is not sufficient that the diet contains the denominated protein, fat, carbohydrate, vitamines, mineral matter, etc. It must contain them in certain ways; it must be prepared according to certain standards; it must be consumed under particular surroundings; it must be served in accordance with selected procedures. A thousand and one external influences determine whether or not a diet, correct

in itself from the standpoint of animal physiology, will be regarded as correct and proper by the consumer. The appearance of food, and its palatability, and the previous experience of the individual have a determining influence so profound that they may actually prevent the digestion and utilization of a particular foodstuff. It is thus true, not as a matter of notion but as a matter of fact, that a diet that would be entirely proper and comfortable for a Russian peasant would fail as nourishment for the highly specialized organism of a Russian artist. There is of course a great deal under cover of the term "psychology of nutrition" that is purely arbitrary idiosyncrasy, that will disappear under repression. There is, however, a great deal that is real and that bears directly not only upon the ingestion of food and upon the sense of satiation but operates also to alter the normal processes of digestion.

In a period of stress, such as at present confronts the American people, it is incumbent upon every family to attempt a separation of the true psychology of the diet from false psychology, idiosyncrasy, and from the fads with which our ideas of diet have become infested. We have a maze of nonsense surrounding our ideas of food that must be removed if we are to face clearly and handle efficiently the food problem that confronts our

people. So long as people believe that corn meal is heating, that barley cannot be eaten in summer, that the quality of meat is determined by the size of the animal, that the digestibility of eggs varies with the colour of the hens, etc., etc., that long will it be impossible for such individuals to reconstruct their diet to conform to the correct physiology and psychology of alimentation. It is necessary to retain those features of the psychology of alimentation that make for refinement in life and satisfaction in nutrition; but also equally necessary to discard wasteful idiosyncrasies, vulgar superstitions and pseudo-scientific fads.

INFLUENCE OF TRADE

Trade influences our diet either essentially as a result of trade conditions or through manipulation. Commercial trade practices influence to a large extent the consumption of foodstuffs in the United States. It is a truism among the manufacturers of foodstuffs that a properly conducted, adequately financed campaign in advertising will create a market for any new foodstuff, irrespective of any question of superiority from the nutritive point of view. The history of breakfast foods is an illuminating illustration. There is no nutritive basis for the establishment of any one or for its replacement by another. The factors that count most in ad-

vertising are method of preparation, saving of labour by the housewife, taste, attractiveness of the package, keeping qualities, in other words, secondary considerations. The prices are high compared with that of the original cereal from which they were derived; for the price covers the advertising, the cost of the special package, the marketing, the bulky freight tonnage, and the overhead charges of the retailer who has to carry many brands that occupy much space upon his shelves. None of these fancy breakfast foods have any nutritive superiority over the cereals out of which they are manufactured. They represent the desire of the American housewife to save work, to have something new and to serve an infinite variety of cereals.

Such an influence of trade is purely artificial and is based largely upon the restlessness of the consumer. There are, however, other trade influences of an entirely different nature. The trade pushes certain commodities because handling of them is profitable; conditions of transportation, portability, keeping qualities, evenness of production, ability to purchase by contract, financial responsibility of the producer, standardized quality of the wares, etc., all are involved. The grocer takes up each new breakfast food as an ephemeral trade, knowing that it will soon be supplanted. He takes up a certain line of bacon knowing that it will be always the

same; the firm manufacturing the article is responsible, the product is guaranteed, and it represents a staple in the mind of the consumer. In this sense, that which is staple in trade becomes a staple to the consumer. The flour of a certain section keeps better than the flour of another section; the sweet corn of a certain area is tenderer than that of another region. A large number of such trade factors will at once suggest themselves to the reader. They are essentially related to conditions in the supply and themselves really represent adaptations of the trade to conditions in the supply.

Now, in times of stress, trade conditions cannot be maintained, and particularly under conditions of war, with disorganization of labour and transportation, it becomes increasingly difficult for the trade to maintain its standards. This results in disorganization of trade values, depreciation of the worth of markets, and sophistication of foodstuffs, adulteration, and lowering of values. The standard article costs relatively and absolutely more to produce than the ordinary article, and with the differential between the two becoming increased, there is motive for sophistication and the consumer is tempted to leave the standard staple. A strict enforcement of pure food laws under these circumstances, though very much more difficult than in peace time, becomes the absolute duty of the gov-

ernment. Prior to the declaration of war against Germany by Italy, Italian exporters flooded Germany with sophisticated foodstuffs that were eagerly seized in the condition of stress in Germany because of the attractiveness in price distinction. It is difficult to enforce pure food laws under these circumstances because many of our pure food laws represent not factors of nutrition, but rather factors of trade. It is so easy for a manufacturer to allow his product to vary from his statement of contents if it is difficult in the markets to secure the substances necessary to maintain in the content the statement of contents.

In the United States at present, it is practically impossible to secure for purposes of manufacture the assortment of imported wares from the Orient, peppers, spices, etc., that were available in peace time, and it becomes very difficult for the manufacturer of a trade-mark brand to maintain the content under which his market was originally developed. Under conditions of stress it becomes much more difficult to grade grains and the manufacturers of flour find it increasingly difficult to select grains and blend them in order to produce the flour to which their trade has become accustomed. When cattle are rushed to market in poor condition and pigs at a very low weight, it is difficult for the packing houses to maintain the standard

of their products. Throughout the entire trade, the temptation to use fillers that are innocuous, but devoid of nutrient value, is difficult to resist. Freedom of action in the trade is much restricted under conditions of war, and such restriction in freedom of action often so operates to modify the influence of trade as to render it pernicious. On the other hand, the efficiency of governmental machinery in the maintenance of food laws is at the same time greatly reduced. When things are scarce and prices are high, even if speculation be eliminated, the very attitude of the consumer tempts to a modification of the normal factors of trade, and these modifications are usually in the direction of inefficiency in terms of final analysis in food units. It is the business of the government, when the available foodstuffs must be utilized to a more complete extent, to itself control this utilization in place of leaving it to the decisions of the interested traders. It is not merely the function of the government in war time to increase production, to eliminate speculation, to govern distribution, to make equitable division of foodstuffs to the consumer, to teach the consumer proper utilization of foodstuffs and the elimination of all waste; it is also the duty of the government to so control relations of trade that the diet of the consumer is not unduly modified and to his detriment. Any modification in the factors

of trade in war time will tend in the direction of reduction of efficiency in nutrition, never in the direction of improvement.

The question of trade brands represents one of the peculiar features of the situation that merits a moment's discussion. If the established high-grade trade brands are maintained in war time this will usually be done at the expense of the quality of the remaining foodstuffs. The people of means will purchase the standard maintained brands, leaving to the poor the depreciated grades of foodstuffs. There is no reduction in price, however, that corresponds to the depreciation of foodstuffs to the poor classes. The prices of the standard high-grade brands are relatively the cheapest under such circumstances and yet they are beyond the purchasing power of the poorer classes. This leads to class resentment and to inefficiency in the nutrition of a people; and this has led the European governments practically to abolish such brands during the course of the war. There is, for example, in Germany, England and France today, only a war flour; the high-grade brands of the mills of those countries have been abolished for the period of the war. Germany used to produce particular varieties of foods that were widely exported—hams from Westphalia, sausages from Braunschweig, cakes from Württemberg, chocolates from Mannheim,

etc., etc. These have all been abolished; cakes have a uniform composition, hams and sausages are prepared in a uniform manner. The products of highest quality no longer exist, but the general average is above that which would have existed in the lowest grades had the products of highest grades been maintained.

To abolish the high-grade trade brands means of course an extremely radical step, one not to be taken without mature consideration, since it represents practically a revolution in the practices of the trades. In countries actively at war under stress of abnormal conditions this becomes absolutely necessary. It has not yet been necessary in the United States to abolish the high-grade brands as has been done abroad; but if here, as abroad, the quality of the ordinary goods becomes seriously depreciated, we may expect strong public clamour for similar action to be carried through here, because under such conditions the maintenance of a high-grade trade brand means not merely a commercial privilege to the particular producer; it means a direct favouritism to people of purchasing power, and this leads to class discrimination, bitterness of feeling and reduction in morale.

CHAPTER VI

THE SOCIOLOGY OF NUTRITION

IN the previous chapter we discussed the physiology of nutrition, the nutrition of the individual from birth throughout life under the varying exigencies of a normal existence in the economic and social sense. Under sociology of nutrition we understand the nutrition of a people regarded as a unit. While in the superficial sense one might regard the nutrition of a people as a mere multiple of the nutrition of an individual, this is far from the truth. Under the normal conditions of life the problems in the sociology of nutrition are largely concerned with the alimentation of the poorest classes. The problem of feeding and housing the masses who, through limitation in capacity occupy necessarily the lowest station in the scale of wage, has become with each decade a more engrossing and imperative problem of society. Investigations have been carried out in numbers by governmental agencies. Efforts for the amelioration of these conditions have in this country been largely carried out through eleemosynary organizations and in particular instances through

the industrial corporations which, far-sighted in advance of their time, have come to the realization that industrial efficiency is incompatible with inefficiency in alimentation of the labourers. But nowhere except in Germany has the state entered comprehensively into the work of amelioration of the conditions of life indicated in a comprehensive definition of the sociology of nutrition. Whatever one may think of the military caste and class of Germany, the fact remains that before the war Germany was practically the only nation in the civilized world where governmental agencies existed designed to prevent sub-nutrition not only in classes but in individuals.

The problems of the sociology of nutrition are largely zonal. There are zones of large earnings as against zones of minimal earnings. There are zones of large production of foodstuffs and zones of low production of foodstuffs. Sub-nutrition is as frequent in certain agricultural areas as it is in cities. For the most part, viewing the problem of the sociology of nutrition from the standpoint of the historic doctrines of political economy, it is apparent that sub-nutrition in classes results partly from the cruel and unyielding application of the law of supply and demand and partly from abrogation of the operation of this law through manipulations in the processes of distribution, involving cornering of

the market, arbitrary deflection of the laws of trade, speculation and extortion. It is most perplexing to determine in a particular instance whether the inability of the individual to cover his nutritional needs with the money at his disposal depends upon the natural disparity of his buying power with conditions in the market of commodities; or whether the limitation in his buying power is due to his inability to reach the market of commodities, closed to him by an artificial interference with the law of supply and demand. Quantitatively viewed, it is probably a fair statement to say that at all times five per cent of the people of this country are on the verge of sub-nutrition and that in times of industrial stress this proportion may rise much higher. The phenomenon is zonal, whether the result of the application of the law of supply and demand or the result of artificial abrogation of this law. The acute stringency in foodstuffs that developed in New York City during the fall of 1916 is fresh in the minds of readers.

Now under conditions of war time, new factors intervene that operate in two directions. They operate at first in the direction of intensification of the application of the law of supply and demand. They also operate to place greater powers in the hands of business interests to abrogate the law of supply and demand. When, however, the opera-

tions of war become very intensive and extensive, the law of supply and demand collapses. At first thought, one might be inclined to doubt the truth of this statement. Even in Germany, the objector could urge, so long as a rich man, if he has the \$75, can buy a goose for that figure, surely the law of supply and demand still holds. The illustration is trivial and based upon a superficial consideration. When the people of the northwest have the money to buy coal and the coal mines have the coal at the pit and a delivery is made impossible through the break-down of transportation, it is idle to say that the law of supply and demand still holds. The chief factor in the break-down of the law of supply and demand is the state of transportation. Through specialization of industry throughout the world, based upon fluidity in transportation, production in agriculture and manufacture have become more and more specialized, more and more zonal. The moment transportation fails to effect an obliteration of these zones, the law of supply and demand ceases to be operative. Wheat lies in hundreds of million bushels in Australia and India, sugar in the hundred thousand tones in Java. Yet no insistence in the call of the purchasing power of the rest of the world suffices to bring them out. Starvation exists in Petrograd and want along the Russian front, while grain lies piled up a few hundred miles to the rear.

One of the chief factors in manufacture is power and this power is usually derived from coal. The entire manufacturing scheme of the world today is upset through the break-down of the transportation of fuel; and this disorganization extends to the producer of the raw materials upon which manufacture is founded. There are other factors operative in addition to the breakdown of transportation, but this is the most potent in disastrous results. Less food is produced in the world, and more is consumed, since war is hard work. But whatever factors enter, these could be compensated for if transportation, using the term in the large sense, could be held to the normal plane of efficiency. Break-down of transportation may be relative or absolute; relative, when shipment of the necessities is neglected on account of preoccupation with military tonnage (as in America), absolute when the total carrying power of the transportation systems has fallen below normal (present condition in Germany).

The break-down of transportation affects the sociology of nutrition in that it renders the zones of production more distant than in peace time and increases the differential between price to the producer and cost to the consumer. It also involves the production of foodstuffs because it disturbs the natural flow of machinery, fertilizer, and disar-

ranges the normal regional fluctuations of labor. While, therefore, in the specific and superficial sense it may still be true that the law of supply and demand holds, in the sense that if a packing house has a million pounds of lard it goes to the highest bidder, in the broad sense the law of supply and demand does not today hold in the United States and all considerations directed to the maintenance of the normal sociology of nutrition must be based upon recognition of this fact.

In the nutrition of a nation, as in the nutrition of an individual, we must distinguish two spheres, if the term may be so employed, namely, the sphere of necessity and the sphere of adaptation. In the diet of an individual certain amounts of balanced protein, fat, carbohydrate, water-soluble vitamine, fat-soluble vitamine, and mineral salts are essential. Beyond this point, the individual may adapt his diet to the circumstances of his surroundings. In the nutrition of a nation, the minimal amounts of protein, fat, carbohydrate, vitamines, and salts qualified to maintain the total population in a condition of normal health and strength are included in the sphere of necessities. The zone of adaptation includes everything outside of these. Viewed in the quantitative sense, 20 to 25 per cent of the foodstuffs of a nation lies in the sphere of necessities; the remainder lies in the sphere of adaptation. In order to

maintain the efficiency of the nutrition of a people, the food control of a nation at war must guarantee to the entire people, irrespective of other conditions, the minimal amounts of the named constituents of a normal diet that are essential to nutrition. There can be no zone of over-feeding in these essentials in one part of the country and a zone of under-feeding in another. There must be an even average application; otherwise, disaster lies ahead. Once this is attained, the remainder of the foodstuffs necessary for nutrition and the maintenance of work may be adapted in the zonal sense by substitution to the conditions of production in the particular area.

Now, in the order of their importance, what are the elements in production that must be maintained and guaranteed in equitable distribution in order that the nutrition of a people shall be maintained under the stress of conditions of war?

MILK

First and most important is the milk supply. Milk, including of course butter and cheese, supplies the essential growth vitamine for children, balanced protein for children and adults, and an adequate supply of mineral matter for children. Milk has in addition invaluable properties in the cuisine of an Anglo-Saxon people. A certain amount of milk is required in the preparation of our food and

if absent this would so disorganize the condition of our food and alter its qualities from the psychological point of view as to exert a disastrous influence upon national alimentation. Viewing the matter by and large and erring always on the side of safety, it may be said that the milk consumption of the United States should not fall below one pint of milk per capita per day, or approximately 45 gallons per capita per year. The milk production of the country has steadily fallen from 95 gallons per capita per year to probably 70 gallons today. A range of from 45 and 70 gallons would seem to be a wide leeway, but as a matter of fact it is much less wide than the figures would indicate. We must subtract from the 70 gallons the milk corresponding to the butter and condensed milk that are exported, a not inconsiderable fraction at the present time. The consumption of milk in country districts is inevitably higher than in cities. The greater the production of milk over 45 gallons per capita, the greater the chance that each individual in the cities will receive that amount per year; the narrower the margin, the more doubtful the equitability of distribution. There is good evidence to indicate that during the past six months large groups of population in the United States have not received 45 gallons per capita per year and this not as an expression of mere poverty. The price of feed has

been very high. There has been a decline in the relative effort of dairying as a whole, a tendency to get out of the dairying business, throughout the country, because it has not been possible to increase the sale price of milk in proportion to the cost price of feed.

The remedy lies primarily in increased milk production. Necessary to this end are increase in the supply of feed, reduction in the price of feed, alleviation of the stringency of labour on the farm, organization and control of the distribution of milk, reduction of general waste, elimination of special waste of skimmed milk attending the manufacture of butter and cheese, the placing of skimmed milk on sale in the cities, and reduction in the cost of delivery. The whole practice of distribution and retail sale of milk needs a thorough overhauling. We ought to aim to increase as rapidly as possible the number of milch cows from the present 22,000,000 to 26,000,000, and this increase must of course be with productive strains instead of nondescript stock. It must be clearly realized that the problems involving milch cattle and beef cattle are distinct and separable. One cannot turn beef strains into the dairy or dairy strains into the feeding stalls with other than indifferent results. To a large extent therefore the problem of the production of milk is just as distinct

from the problem of the production of beef as it is from the problem of the production of mutton.

Milk is always produced in an intensive manner in zones that correspond to congestion in population. Now, unfortunately, the zones of production of concentrated feeding-stuffs and the zones of production of milk need not coincide. The principal concentrates in the feeding of milch cows are grain offal, linseed meal, oil cake, peanut meal, and various legumes, including soya beans, cowpeas and velvet beans. The grain offal is produced in the areas of milling. The dairy districts of Wisconsin, Illinois, Minnesota and Iowa lie contiguous to the great milling centres and are thus able to obtain mill feed at reasonable rates, but the great dairy areas of the East lie distant from the milling centres. Linseed meal is produced largely in the northwest, again adjacent to the areas of milk production; but oil cake, peanut meal, and the various legumes are produced in the South where dairying is but slightly developed. The dairying areas of the West occupy a much more favourable position than the dairying areas of the eastern states and yet these serve an intensely congested population.

An intensive development in dairying in the indirect sense has been evolved in Europe but has received little attention in this country. This is the combining of the processes of making butter and

margarine. In this country butter is made from cream secured by the centrifugation of milk and the skimmed milk is then either fed to swine or thrown away — thrown away, unfortunately, to a very considerable extent. In Europe, this skimmed milk is used for the further manufacture of margarine. Vegetable and animal fats in proper proportion, largely vegetable fats, are mixed with the skimmed milk and churned out just as butter would be, and this process may be repeated. In this way a very good product is obtained which has flavours derived from the milk. Within recent years in Denmark it has been the practice to export nearly all of the butter and to consume in Denmark margarine made by the churning of imported fats. Margarine is commonly called a butter substitute. It is, however, not a butter substitute but a supplementary table fat. Butter has a unique position in the diet, particularly for children, and there is no substitute for butter from this point of view. In the per capita ration of a half pint of milk per day is included the butter fraction that is deemed essential for the health of our people.

Beyond this amount of milk, however, fat is needed in the kitchen and on the table in the same way that butter is consumed. This fat must have some of the physical characteristics of butter and these physical characteristics can be given to it if

manufactured into margarine in accordance with modern methods. It is necessary in the United States to increase the consumption of vegetable oils. It is impossible to increase the consumption of vegetable oils as such; they must be passed through some sort of a fabrication in order to give them physical qualities that are in themselves desirable. This can be accomplished in one of two ways, either by hydrogenation or by the manufacture of margarine. Hydrogenation of a fluid fat results in a solid product. It is a chemical procedure, has no result upon the digestibility or food value of the product and represents an advance in the utilization of fluid fats. An ounce of water-free butter, hydrogenated fat, and margarine are equally valuable from the standpoint of digestibility, utilization and energy content. There is not enough butter to go around and if good substitutes are not supplied, the consumption of fat falls. People will use hydrogenated fats and margarine where they refuse to use olive oil, cottonseed oil, palm oil, peanut oil or corn oil, simply because the use of fluid or semi-fluid oils lies outside of the habits and customs of an Anglo-Saxon people. There is no such problem in Italy or France because the people understand the use of olive and other oils; but the problem does arise with every northern people and there are but two solutions; either the people must be taught to use fluid vegetable oils as the peo-

ples of the South employ them, or these fluid vegetable oils must be converted into such a state as meets the customs and habits of the people. The hydrogenated fats are practically limited to the kitchen; the place of margarine on the other hand is at the table. This is not a question of price, it is not a question of trade competition; it is a question of increasing the available fat food of our people. It can only be done by increasing the production of butter or by the manufacture of margarines that meet the tastes of an Anglo-Saxon people. Viewed properly, margarine, hydrogenated fats and butter are not competitive; they are supplementary; and the very viewpoint in food control that insists most strongly upon increase in the production of dairy products must at the same time urge the manufacture of margarine and commend its use. The dairyman and creamery should manufacture margarine just as they manufacture butter, butter being the product of the primary churning, margarine the product of the later churning.

A survey of the development of the utilization of the nation's milk supply over the past three decades illustrates that here as elsewhere efficiency in the utilization of milk from the nutritional point of view has been reduced owing to the increased demand for butter. The percentage of our total milk production that is devoted to the manufacture of butter has

gradually risen to approximately 60 per cent. Two decades ago the rural communities, including in this term the small towns, consumed a much larger amount of milk per capita than now. With the introduction of the separator and the perfection of dairy methods, it became profitable for the farmer to dispose of his milk in terms of butter fat with only partial utilization of the skimmed milk and this almost entirely by domesticated animals. There is in this country practically no such thing as the manufacture of skimmed-milk cheese. Viewing the production of milk as a whole, the centrifuge has led to reduction in the consumption of milk as human food and increase in the consumption as butter. The same thing is true in Europe and the introduction of the separator into the highland districts of Bavaria has produced such a transformation in the diet of the people as to constitute a sociological problem.

Viewed from the standpoint of utilization it is much more efficient if milk can not be consumed as milk, to consume it in the state of cheese than in the state of butter, since the cheese contains all of the fat and the protein in addition. This fact is the basis for the recommendation of the British food committee that the production of butter be reduced and the production of cheese increased. On the continent, skimmed milk is not wasted. Large amounts of skimmed milk are consumed directly,

and a great deal is used in the manufacture of skimmed milk cheese; the balance is used as a concentrate in the feeding of swine. Dried skimmed milk represents a large future possibility of protein nourishment. Used in the kitchen in proper proportions, dried skimmed milk and vegetable oil represent a substitute for full milk and eggs in the preparation of foods, being for practical purposes inferior to eggs only in the absence of colour.

BREAD

The second indispensable part of a national diet is bread. Bread constitutes everywhere, in the quantitative sense, the keystone of a nation's ration, as illustrated in the following table :

Country	Bread grain as flour in grams per day	Protein per cent of total in diet	Calories per cent of total in diet	Other cereals in grams in diet
United States	265	29	31	78
Great Britain	285	29	32	48
England	310	32	36	32
Austria-Hungary	310	40	45	75
Germany	310	34	40	14
Italy	340	43	40	98
France	410	45	53	40

The indispensability of bread in the ration is due less to its intrinsic qualities than to external properties. The proteins of cereals are not balanced pro-

teins. Grains contain very little fat-soluble vitamine and in a mixed diet the presence of the water-soluble vitamines of cereals is a negligible factor. The external properties upon which the indispensability of bread in a ration rests lie in the physical qualities of the glutens and allied proteins that permit of bread being made in the form of a loaf that can be prepared in large lots of a uniform quality and appearance, with keeping qualities enabling the storing of supplies. All peoples consume cereals cooked and not baked in the form of bread, some even predominatingly as in the case of the rice of the Orient. Since the desirability of bread is based upon external qualities, wheat ranks the highest among the cereals, rye and barley next in the order named, and oats and maize last, in proportion to the quality of bread that may be produced from flours of these cereals. Wheat flour produces the whitest bread of the lightest and best texture, uniform in quality, although it does not keep as well as rye bread. In the earlier periods of the development of European nations barley and rye were the standard breads; barley was first replaced by rye and rye has been later more or less replaced by wheat. In proportion as a continental nation has risen in purchasing power, it has supplanted the use of rye bread by wheat bread and when a period of stringency arises, it reverses the process and returns to rye bread. This is due to the

fact that the unit of production of rye per area and per man labour is for most sections of the world larger than for wheat, the conditions of the growth of the grain being more adaptable, although there are many local exceptions to this rule.

Nutritionally the cereals in a mixed diet are approximately equivalent. Corn and oats are somewhat richer in fats, and oats and wheat are somewhat richer in protein. Rice is the poorest in protein. All of the cereals are poor in fat-soluble vitamine; all are rich in water-soluble vitamine and mineral matters. In a mixed diet, therefore, these various cereals can be used to replace each other in any proportion so far as nutritional units are concerned.

The amount of the diet covered by the use of cereals will determine the state in which the cereal ought to be employed in the diet. In the proportions given in the table, if the diet contains the normal amounts of dairy products, fruit and vegetables, it is immaterial how the grains be consumed. The finest, whitest patent flour represents about a 56 per cent extraction of standard wheat; that is, a 60-pound bushel of first-grade wheat will yield about 34 pounds of the best grade of patent flour. There are several grades of patent flour and so-called straight flours included in the production of the large mills; and a fair average for the percentage of flour ex-

tracted from the unit of wheat in this country is about 72 per cent, with a water content of about 13 per cent. The remainder of the grain, representing in toto 28 per cent of the weight of the wheat, is termed grain offal and includes a number of fractions known in the trade as "red dog," "shorts," "middlings," and "bran." These include the outer layers of the kernel and the germ.

The grain offal contains a higher percentage of both protein and fat than does the fine patent flour and also a larger percentage of mineral matter. The mineral matters and the water-soluble vitamine that are present in the outer layers are of importance in the diet, but cereals are not the sole source of water-soluble vitamine and mineral matter. These can be obtained also in fruits and vegetables; and to the American subsisting upon a mixed diet it is possible to cover the needs of the body for mineral matter, water-soluble vitamine and roughage, either by employing the outer layers of the grain in the form of so-called whole wheat flour, or by the free consumption of fruits and vegetables. One of these two must be included in the diet; but it is immaterial which of the two is employed. Now, if the total cereal fraction of a diet runs toward the lowest figures given, in other words, toward one-third of the total food value of the diet, the use of the whole grains is of little importance. If, on the other hand,

a group of men attempts to live largely upon flour, with the addition for example of pork products, it would be imperative to use whole wheat flour rather than patent flour. In the ordinary use of rice in the American home, it is immaterial whether one employs polished rice or whole rice; but in the use of rice in the Orient it is imperative to employ whole rice for at least a fraction of the diet. Nutritional diseases which appeared in one of the armies of the present war, due to limitation of the diet to white crackers and canned meats, were promptly cured by the administration of water-soluble vitamine in the shape of yeast. The belief, however, that the health of a people as a whole depends upon the general use of whole-wheat bread as against white bread is based upon a misconception of the actual relations of the vitamines and salts in a mixed diet.

The diet of our people is built around bread and milk. It is therefore essential at this time that the normal ration of bread should be maintained in order to permit the widest adaptation around these central factors. It is also psychologically necessary to maintain the quality and physical properties of the bread. When grain becomes scarce one has the choice between maintaining the quantity and altering the quality, or maintaining the quality and reducing the quantity. In general, the practice has been to main-

tain the quantity and lower the quality, though there are indications that this is very easily overdone. The maintenance of quantity may be accomplished in one of two ways — by a higher extraction of the grain and by the use of mixed flours. In the European countries at war, the milling of wheat and rye has been advanced from the customary extraction to about 81 per cent. This 81 per cent in England includes as much as 17 per cent of water; in Germany, not over 14 per cent; so that the actual extraction is highest in Germany. The reason for setting the figure 81 is the fact, determined by experiment, that, using protein as the criterion, an 81 per cent extraction represents the maximum of utilization in the process of digestion; and since the grain offal is of great value in feeding cattle, there is no gain in using a flour of higher extraction. The use of such flour assures the maintenance of the quantity of the loaf with a reduction in the grain of approximately one-sixth. The normal French ration of bread was in the neighbourhood of a pound and a quarter per day. The present war ration is a pound and an eighth, but the quality of the bread is lower. There is a widespread agitation in France to secure an optional regulation, permitting a choice between 500 grams of bread prepared from an 85 per cent flour and 400 grams of bread prepared from a 72 per cent flour. There has also been much complaint in Germany

against the coarse bread, and government regulation provides that in the case of invalids it is permissible to use a bread prepared from flour of lower extraction.

The use of mixed flours presents points of advantage over a higher extraction of the cereals in the milling. Standard flour may be mixed with 15 to 25 per cent of flours of rye, barley, oats, rice, or corn, with the maintenance of the physical properties of the bread, with little change in taste, and with the production of bread which to a great many people is preferable to a straight wheat bread of the graham type. The best way of looking at the matter in a democratic country is to accord freedom. Our government has not altered the milling of the wheat in the manufacture of flour. But we are short of wheat. We urge the use of whole wheat flour and the use of mixed flours, leaving it to the discretion, taste, and patriotism of the individual to employ standard flour, whole wheat flour or mixed flour in such proportions as may be elected. With such stringency in the supply of cereals as is now prevalent in Europe, this is not possible. The choice is there limited to whole wheat flour or mixed flour and where the stringency becomes marked, as in the case of Germany, there is no choice whatsoever; the state prescribes a flour composed of whole wheat flour plus the admixture of flours of other cereals.

One of the standard breads of Germany during the past six months was composed of 55 parts of wheat flour and 45 parts of rye and barley flour. If the barley be milled to a low extraction, as 60 per cent, the flour produced is one of the best for admixture with wheat flour, having the least influence upon the final product, with slight alteration in taste; but if barley be milled to 75 or 80 per cent, it usually adds to the bread a slightly bitterish taste. The addition of rice flour tends to contribute a pastry-like quality. The addition of rye darkens but does not otherwise modify the loaf or taste to a material extent. The addition of corn tends to make the bread granular; it dries more easily and does not keep so well. The addition of potato, unless very carefully done, tends to make the bread soggy, a hard crust with an area of underbaking in the centre. Potato starch or potato flour has always been used on the continent in the preparation of the finest pastries and a certain amount, up to possibly 10 per cent, can be used with careful methods in the baking of bread without leading to untoward results; but the potato bread of Germany of a year ago was an abomination in the eyes of the baker and consumer alike, since it contained so much potato that it was not possible to produce an article that the baker or consumer regarded as an acceptable bread.

The decision as to which alteration in bread

should be adopted rests to a large extent upon the habits of the people. If the people are predominantly home bakers, then the freest choice should be permitted. If the people, on the contrary, are supplied by outside bakers, then early regulation is preferable since it will lead to the establishment of a definite technique and the production of a standard loaf. On the continent of Europe there is very little domestic baking, practically all bread is purchased. In this country about 55 per cent of our people consume home-made bread; and under these circumstances a moderate latitude ought to be permitted, in the event of regulation for the control of bread becoming imperative.

Another important factor in connection with the type of flour employed depends upon the habits of the people in the purchase of flour. If a people consume flour soon after its production, it is possible to place upon the market a flour of high extraction, whereas this is not the case if the flour is held in the household for a longer period of time. The white flours keep well; the whole grain flours keep badly. The eggs of insects are often deposited in the grains and, in addition, bacteria are always present in the germ. It is this tendency to decomposition that accounts in part for the high price of whole grain flour. In a small country like England and especially in a country where bread is bought largely

from the baker, the time that elapses between the day of milling and of production of bread is only a few weeks. In this country flour must keep four, five, or six months if it is to give satisfaction, since a great deal of bread is made in the home from flour milled long previously. A flour that would be satisfactory in keeping qualities in Germany would be unsatisfactory in the United States; and there is no way of compelling people to buy flour in small amounts and use it quickly, in other words, to regard it as a perishable when according to all domestic experience flour has always been regarded as a non-perishable. It has been entirely practicable for the British to produce an 81 per cent flour in England; but it did not prove practicable to buy an 81 per cent flour in the United States and ship it to England under present conditions of tonnage, because there were heavy losses from decomposition. From this point of view, as an obligatory measure the use of mixed flours would be more advantageous in this country than the use of whole grain flour.

War-time experience has indicated that the cereal consumption of a people need not be given entirely in the form of bread. A certain bread ration must be determined, otherwise the diet does not seem natural and the restriction will provoke resentment; but beyond a certain point cereals may be substituted for bread. In our northern states the flour con-

sumed is somewhere in the neighbourhood of eleven to twelve ounces per capita per day and the consumption of other cereals somewhere in the neighbourhood of two ounces, including the breakfast foods. In our southern states, the consumption of flour is six or seven ounces and the consumption of other cereals six or seven ounces. Indeed, in many sections of the south, not over one-third of the grain consumption is in the state of bread, the balance being in the state of rice and corn.

Even with the nations that cling most desperately to the use of bread in the diet, a certain amount of bread may be replaced by other cereals. In England, they have encouraged the use of oat meal, corn meal and rice, and reduced the bread ration, especially in the middle and upper classes. In Italy, it has been possible to increase the use of rice and corn to the point of reducing bread consumption to one-third of the intake. Large classes in Italy are content to consume their cereals in the form of pastes, corn and rice, with only the occasional use of bread. During this war, the Germans found no difficulty in using such amounts of other cereals as were at their disposal. It is only in France that it has been difficult or indeed almost impossible to reduce the bread ration, which is today practically what it was in peace time. The reason for this is deserving of more than passing mention, since it is

imperative that we should understand the exact situation. There is no such thing in France, practically speaking, as domestic baking of bread. The bread is always purchased from the baker, it is usually purchased for a long period of time and must keep well. The French are perfectly willing to have a bread made of mixed flour containing rye, barley, corn, or oat meal, but they insist that the cereals must be in the form of bread. Corn bread cannot be made in a bakery and sold. If the French people are to use corn, oats or rice in excess of the amounts that can be introduced into the loaf with wheat, such use must be in the home. In other words, the labour of preparation of rice, corn meal or oat meal must be imposed upon the Frenchwoman.

But this represents the imposition of a considerable burden. In the first place, the Frenchwoman does not understand how to cook these cereals and she would first have to be taught how. The children of France do not understand the taste of these cereals and they would have to be taught to eat them. The actual time and fuel consumed in the preparation of these foods would represent a serious sacrifice. It must be clearly visualized that all of the able-bodied men in France are at the front, engaged in transportation or in the manufacture of implements of war. The only men at home are old men,

the hundreds of thousands afflicted with tuberculosis, and the hundreds of thousands incapacitated by wounds. The Frenchwoman is carrying on the agriculture and in the cities the Frenchwoman is carrying on all of the odds and ends of labour that normally fall to masculine hands. On top of this, is it to be regarded as possible to ask the Frenchwoman to spend an hour in the day in the preparation of rice, corn or oat meal? Certainly no American who understands the meaning of the war can possibly justify such an imposition upon the women of France. This is more than a matter of judgment, it is a question of conscience. France has done much for us, this little we must do for France.

We are short on wheat and long on other cereals. We are short on wheat because our wheat crops have been low for two years, the excess wheat of Australia and India is inaccessible on account of conditions in transportation, and in addition to this we have the obligation to ship increased amounts to Europe because the wheat crops have failed upon the fields of our Allies. This can be accomplished only by a reduced consumption of wheat and an increased consumption of other cereals. We have already in 30,000,000 Americans in the south an illustration of what should be the practice of every one. If the people of the north would reduce the consumption of wheat to the point approximating

the average consumption in the south and consume instead the other available cereals, this would set free for export practically 150,000,000 bushels of wheat. It ought to be left open to the widest choice of the individual family how this substitution shall be effected. Some will elect to save on flour by the use of whole wheat bread; others will elect to prepare bread from mixed flours; others will elect to use bread of the usual type, but reduce the consumption one-third and replace it with cereals. People who buy bread must necessarily adopt the latter course. It will probably be possible to evolve a war bread at a lower cost and including the flours of other cereals. There are hundreds of ways of preparing corn meal, hominy, oat meal, barley, and rice. Some will prefer wheatless meals, others will prefer wheatless days. Under these circumstances, there are but two explanations for failure in any family to replace wheat with cereals in accordance with the necessities of the case — these are sheer selfishness and disloyalty — and of these no discussion is necessary.

CHAPTER VII

THE SOCIOLOGY OF NUTRITION (Continued)

MEAT

THE amount of meat and meat products required in a normal mixed diet is much lower than the amount consumed in the United States. If the normal consumption of milk be maintained, the necessity for meat from the standpoint of intake of balanced proteins is much reduced. If each individual in the United States consumes a half pint of milk per day, the amount of meat that may be regarded as necessary does not exceed two ounces per capita per day. If milk and dairy products are absent from the diet, meat ought to be increased to a minimum of four ounces per day. The per capita meat consumption in this country is somewhere in the neighbourhood of 160 pounds per annum. Contrasted with this figure, the amount denominated as advisable from the nutritional point of view, is only about nine-sixteenths of the present consumption. From the standpoint of their content in fat-soluble vitamine beef and mutton

are superior to pork. Lard and bacon are indeed almost devoid of the substance. A diet of white bread and butter is a competent diet from the standpoint of the fat-soluble vitamine, but a diet of white bread and lard is not a competent diet. This argument holds only for the small fraction of meat denominated as essential from the standpoint of vitamine. Mutton represents the first choice, pork the second, and beef the third, from the standpoint of economy in flesh production. By this is meant that a unit of mutton is produced at the least cost of cereals, a unit of pork second, and a unit of beef third. This brings to the fore another feature of milk that is invaluable, considered from a national standpoint. Using protein as a criterion, in the production of milk, beef, and pork under what may be regarded as standard conditions in this country, one-third of the protein of the feed of milch cows is recovered in the milk; from 15 to 20 per cent of the protein of the swine feed is recovered in the pork products; and only 10 to 15 per cent of the protein of the cattle feed is recovered in the beef products. In other words, feed given to a milch cow returns during the course of a year three times as much protein as when fed to beef cattle. A good cow will produce in the course of a year's milk supply two or three times as much protein as will be contained in her flesh. As a par-

tial offset to this from the economic point of view is the labour involved in the dairy as against that involved in the feeding of beef and swine; but even with this included, there is no question of the fact that the production of milk represents the highest recovery of feed units in terms of human food.

A reduction in the per capita consumption of meat is to be recommended entirely apart from any consideration of the total protein of our diet. Nutritionally we need only two ounces of meat per person per day. Meat represents under ordinary conditions an expensive form of protein as compared to that of cereals, though always a cheap source of protein compared to that of most vegetables, including for the most part in this country even the potato. As a source of protein the potato was last spring practically ten times as expensive as meat. Our protein intake is so far above the needs of our body that we may without any question whatsoever reduce the per capita consumption of meat to three or four ounces per day without the slightest hesitation. This does not mean vegetarianism, but it does mean eating meat once or at most only twice a day. To see an American woman serving meat at her table three times a day would impress the French housewife as nothing less than scandalous; and this is as true

from the nutritional as from the economic point of view.

On the other hand increase in the use of fish is to be recommended. From the standpoint of vitamine fish flesh is poor; but considered in the diet in excess of the minimal amount of meat required, fish is in every way equal to animal flesh, unit for unit of protein and fat. The use of salt water fish and other sea food is therefore to be recommended under all circumstances. Meat drawn from the sea is, from the standpoint of nutrition, a clear gain, involving no nutritional losses in its production. In particular, the use of sea food is to be encouraged by the well-to-do. For large classes of our population sea food is out of the question on account of high price. Every pound of sea food consumed by the classes of means saves a pound of beef, mutton or pork for the consumption of the poorer classes or sets free a pound for exportation to our Allies. It is a mistake to urge simplification of the diet upon all classes. The classes who possess means should as far as possible subsist upon the rare, expensive foods, delicacies if you please, like oysters, lobsters, artichokes, in order that a saving may be accomplished in staple meats, resulting in a larger supply and a lower price for the poorer classes and for export. This does not represent favouring the wealthy. It

is a mere economic situation to be utilized for the purpose of a saving in foodstuffs.

A comparison of the consumption of meat with that of dairy products indicates that of approximately 33 per cent of the calories of our diet thus ingested about 19 per cent falls to meats and only 14 per cent to dairy products. When these figures are contrasted with the figures for efficiency in the recovery of feeding units, the extent of the inversion becomes apparent. This ought to be just the other way around. From every point of view, it would be preferable to have the meat consumption reduced to 14 per cent and the dairy consumption increased to 19 per cent. There is much truth in the dictum of Lusk addressed to the housewives of New York City: "Do not buy a pound of meat until you have purchased three quarts of milk."

SUGAR

The pre-war consumption of sugar in this country was the highest in the world, very close to four ounces per day. There are four uses of sugar in the diet sense: (1) in the conservation of fruits; (2) in the cooking of food; (3) upon the table; and (4) in the form of sweets, using this term in the broadest sense to include candies, soft drinks, etc. In peace time sugar was a cheap article of food. Sugar presents no advantages over starch

in the diet except in rapidity of absorption. Sugar is available in the muscles of a working man 15 minutes after it is eaten while starch will not be available for hours. There is a craving for sugar that is natural in children. Sugar contributes enormously to the psychology of the diet and a reduction in sugar, like a reduction in milk, is apt to so upset the cuisine as to make the diet unsatisfactory. With the fullest appreciation of the value of sugar in the preparation of the diet, the fact remains that the American consumption of sugar is nothing less than a luxurious excess and one that ought not to be maintained in war time.

The necessity for a reduction in the consumption of sugar is based upon a sharp reduction in the supply available to the Allied nations. The sugar ration in France and England has had to be reduced to about two ounces. It is imperative therefore that the sugar ration in this country should be arbitrarily reduced or it will be difficult to supply the Allies with even the reduced amounts. It is not advisable to attempt a reduction in the use of sugar in the conservation of fruits, upon the table or in the kitchen, unless the desired result can be obtained in no other manner. The first point of reduction should be in the use of candies, soft drinks, and such articles; the second point of reduction in the cutting down in table use of sugar, using less

sugar in coffee, upon desserts, fruits, and cereals. If Americans will reduce their consumption of candies and soft drinks and the table use of sugar to the plane of peace-time consumption of sugar in continental Europe, we should at once reduce our total sugar consumption by not less than 40 per cent.

Under these circumstances, appeal to the people of this country to reduce the per capita consumption of sugar one ounce per day cannot be regarded as anything less than a most reasonable injunction. A reduction of one ounce per capita per day will set free for export over 1,000,000 tons of sugar per annum. One of the developments of recent years is the multiplicity of shops devoted almost exclusively to the sale of sweets and soft drinks. These cater to the spoiled tastes of juveniles and adolescents and represent an undesirable excrescence in our social development. A distinguished Senator of the United States once remarked that an army of 2,000,000 men could be conscripted between the ages of 18 and 25 if throughout the United States the men who spend their time loafing in candy and soft drink shops and pool rooms could be drafted. The Germans were famous for their *conditorei* prior to the war; but the exigencies of war have practically compelled the elimination of candies, cakes, and soft drinks from the German

dietary. This is one of the most direct measures of conservation available to us.

FRUITS AND VEGETABLES

A traveler observing upon our streets the profusion of shops in which fruits and vegetables are displayed in the most attractive manner might infer that our total consumption of fruits and vegetables is high. Our consumption of fresh fruit is high and our consumption of the exotic fruits and vegetables in general is relatively large; but our total consumption of fruits and vegetables, measured by their rôle in the diet, is low. Not over 15 per cent of the total calories of our diet are contributed by fruits and vegetables. This is due to the fact that we are low consumers of the staple fruits and vegetables. Our consumption of potato, cabbage, beets, and turnips is low. We consume relatively large amounts of string beans and green peas, but small amounts of mature beans and peas. The potato consumption in this country is probably year in and year out not 200 grams per capita per day.

One of the most striking differences in the productivity of Germany and the United States is to be seen in the yield in potato. Within the small available domain of the German empire the annual yield of potato is 45,000,000 tons; in this whole country the average mean yield is 9,000,000 tons,

the difference in favour of Germany being due partly to large acreage in the relative sense and partly to extremely heavy yields through intensive cultivation. Potatoes in Germany have three uses — as foodstuff, as stock feed, and in industry, particularly in the manufacture of alcohol and starch. We do not raise potatoes for stock feed in this country. We feed the culls to live stock only when it is quite as convenient to do so as to throw them away. The fabrication of alcohol from potatoes in this country has never been successfully accomplished and potato starch is a curiosity in our trade. In the south the white potato is rarely consumed; in the north, while the potato appears regularly on the table of most classes once a day, and of some of the labouring classes three times per day, the amounts consumed are small. It is regarded not as a staple, but as an addendum in the same sense that a green vegetable is esteemed. The potato contains only 20 per cent of starch and if it is to form a staple in the diet it must be consumed in relatively large amounts.

In war time the world over the potato has been surrogate for grain. Practically speaking, in a mixed diet five parts of potato equal one part of grain. Agriculturally, in terms of nutritional units, it is easily possible to produce five nutritional units in the form of potato to one in the form

of grain from a unit piece of land. There are of course difficulties in the sudden expansion of the growing of potatoes, as the selection of seed, preparation of the soil, proper fertilization, adequate spraying against parasites. Nevertheless, what can be accomplished is already shown in the potato yield of this year, which is practically one-third more than the mean of pre-war years. The potato yield of this year, sweet and white combined, will be over 500,000,000 bushels, the equivalent of 100,000,000 bushels of wheat, and therefore equal to a sixth of our wheat crop, whereas under average conditions the food value of our potato crop does not exceed a twelfth of the wheat crop.

Now, these potatoes must be eaten in substitution of grain, otherwise, the labour that was expended as a result of an appeal to the patriotism of the country to produce increased foodstuffs is lost. The utilization of such a crop of potatoes brings with it problems of harvesting, storage and distribution, the question of tonnage being one of especial difficulty. Potatoes are raised intensively in certain sections of the country, as Maine, Michigan and eastern Colorado. Many other sections of the country do not raise enough for local consumption. A survey of the marketing of potatoes over a period of five years indicates to what a surprising extent potatoes are shipped from one farming

community to other farming communities. Potatoes are available to enable each individual in the United States to consume four ounces per day in excess of the average consumption of our people, and this is urged upon all classes in all sections; but it is necessary for the authorities so to organize the marketing, transportation and distribution of potatoes as to bring the price down at least to that of grain when viewed from the standpoint of food values.

The potato has certain particular properties in the diet. It is very rich in mineral matter. The potato contains both of the vitamines, and the proteins are more balanced than is usually the case in vegetable proteins. Potato starch is as digestible as cereal starch and the reputation possessed by the potato as a food tending particularly to create obesity is entirely unfounded. There is a very large wastage in the use of potato in the kitchen. In ordinary use this is frequently as high as 25 or 30 per cent, and a careful supervision of the preparation of potatoes in the kitchen represents one of the best opportunities for elimination of waste.

The mean consumption of leaf vegetables in America is low. Of cabbage, spinach, Brussels sprouts and the like, which are especially rich in the growth-stimulating substances, the American

consumption is much too low. There are whole sections of our population to which these vegetables are unknown. Consumption of root vegetables, beets, turnips, carrots, is also low, except among the foreign born population. The Allied armies on the western front have had worked out for them what is believed to be an apparently ideal vegetable ration. The mixture is as follows: Potato, 40 parts; carrots, 20 parts; turnips, 20 parts; cabbage, 10 parts; and onions, 10 parts. These are dried and the total weight reduced to about 17 parts. The difference in the use of vegetables is clearly shown in the employment of such a dried vegetable mixture on the two sides of the northern fighting lines on the west front. On the British side a day's ration of this means a soup prepared through the allowance of 100 pounds of the dried mixture to 6000 men. When the writer calculated the food value of this vegetable ration he remarked that here was at least one good reason why the British "Tommies" were fighting so hard; they were trying to get across the line into Belgium in order to obtain food supplies from the Commission for Relief in Belgium,—since the Tommy's individual portion of this vegetable ration has a food value of not over 20 calories. On the other side of the line, the German portion for a day of such a vegetable mixture represents not less than 200 calories.

Now, that is the whole situation in a nut shell. We use vegetables as flavouring substances. Our French and Italian Allies use them as sources of energy and food values.

When, however, one attempts to urge upon the American people the consumption of more vegetables, exclusive of potatoes, as sources of food-values, one realizes our limitations when the price of the unit values are calculated. Vegetables, estimated as a unit, are today in America from the standpoint of food values, almost the most expensive of foods; in unit cost, tomatoes almost rank with champagne! In order to secure material amounts of protein and carbohydrate from common leaves and tubers, exclusive of the potato, it is necessary to consume relatively large amounts, and at the current American prices this becomes impossible to the poorest classes of our population. The marketing and distribution of vegetables must be so organized as to bring the prices within the range of substitution, so that when a family reduces the use of staples and increases the use of vegetables it can do so at no financial loss.

It will not be possible in all cities to effect such organization on account of extreme congestion of population. It will, for example, never be possible for the East Side of New York to double the consumption of vegetables and reduce the consump-

tion of staples for the same outlay in money; but apart from the congested areas of a few of our largest cities it ought to be possible to accomplish here what has been accomplished in Europe, namely a reduction in the retail price of staple vegetables — including under this term the vegetables that can be kept throughout the winter under ordinary conditions of careful storage — to such a point as to make it possible to substitute them in the diet, without financial loss, for grains or animal products. Nothing indicates more clearly the inter-relation between the purely physiological contemplation of the diet and the economic factors. It is from every point of view desirable to increase the consumption of vegetables. The production of vegetables has already been increased to meet the expected demand; but all of this will go for naught unless the crop is so handled, distributed and marketed as to make the substitution one that does not involve a financial sacrifice. Some vegetables can be stored; others must be canned; others must be dried. There must be correlation over the entire field. From the agricultural point of view, the question is important because a great deal of vegetables can be raised outside of what might be termed formal agriculture, without imposing any additional hardship to a material extent upon labour and fertilizer required in formal farming.

FATS

Fats are contained in dairy products, meats, cereals and vegetables; but the subject of fat in the ration is so important in war time that it is necessary to give the subject a special consideration. The fat of milk contains, as previously stated, the indispensable growth vitamine and is therefore of fundamental importance in the nation's ration. The fat of beef and mutton contains a moderate amount of this substance; that of pork a much smaller amount, reflecting the difference in the diet of these animals. The vegetable oils contain little or none and the fat of cereals also but a small amount.

But fat has other objects in a diet. Fat is indispensable in the preparation of food and, according to Anglo-Saxon custom, almost indispensable in the consumption of cereals. The amount of fat that we have named as a reasonable minimum in the ration of our people is greatly exceeded in fact. The per capita consumption of fat in this country is in the neighbourhood of $3\frac{1}{2}$ ounces. There is a tremendous disparity between the fat contained in food production and fat consumed. A great deal of the fat contained in the extra-edible parts of slaughtered animals is lost, not in the great packing-houses but in the small rural slaughtering-houses

from which proceeds about 40 per cent of the meat of our people. The recovery of vegetable oils is very faulty; we do not begin to recover for human food the oil contained in the various oleaginous seeds that grow within our borders. It is perhaps a fair statement to say that the fat consumption of our people is not over 50 per cent of the fat offered in the produce, disregarding in this calculation the fat contained in cereals that go directly to the feeding of animals. Part of this fat goes into the manufacture of soap and into other industrial uses; part is used in the feeding of animals; part is lost as waste. In the domain of recovery and utilization of fat lies one of the largest opportunities for conservation, and the present campaign of conservation is rightly directing most energetic efforts in this direction.

Fats have become very scarce. We used to import large amounts of the oils of palm, cocoanut, soya, and other seeds from Africa, South America, and Asia. These imports have almost ceased, due to scarcity of tonnage. These fats were employed in part for the manufacture of soap, in part for the manufacture of cooking fats after hydrogenation either alone or mixed with animal fats. They were also employed in the manufacture of margarin. Now with the shutting down of importations of fat, it is incumbent upon us first to recover a larger

amount of vegetable fats grown within our own borders, then to prevent excessive use of fat in industry, to eliminate wasteful use of soap, and finally to reduce fat in the ration. The injunction to reduce the fat in the ration, let us say by one-half ounce per day, will yield a very large amount of fat for shipment to our Allies, to whom fat is more important at present than to us, since their fat ration, viewed as a unit, is not in excess of two ounces per day. The actual working out of such a repression in consumption will, however, in all probability, have a different outcome than the one directly expected. When the attention of our people is strongly extended to the subject of waste in fats and they are advised to reduce the consumption of animal fat one-half ounce per day, in all probability the result will be that the ingestion of fat will remain the same but one-half ounce per capita per day less will be wasted. This is already indicated in the figures for recovery of fat from garbage in cities that possess reduction plants. What one saves for the diet one loses for industry, so far as these cities are concerned.

It is also necessary to effect a re-distribution of the several fats among the different classes of our people. Too much butter is consumed in one class; too little in another. There is too great neglect of dripping fats and also an avoidance of vegetable

oils. What is needed is more equitable distribution of all the fats throughout the strata of society. Our people must be taught to limit the use of butter in time of war to table use. Butter ought not to be employed in cooking, but ought to be reserved for table use and, in particular, for children and adolescents. Dripping fats when properly employed are quite as successful for most purposes in the kitchen. The use of lard ought to be restricted; replaced, in other words, by other fats, because, together with other pork products, it represents the most staple exportable form of fat.

We *must* furnish our Allies with meat and fat. Their herds are depleted, their feeds are reduced, their entire agricultural productivity is greatly restricted and the result is a marked lessening in the products of animal husbandry. Importations from Australia have become practically impossible; those from the Argentine difficult; and in any event Argentine and South America supplied very little of pork products. Our Allies, of course, will use beef drippings and mutton tallow; but the transportability and keeping qualities of lard exceed those of the other products and in any event it is more comfortable to the diets of the people to whom fats are to be exported. The rules, therefore, to be applied over the entire country run to the following effect: Elimination of butter from

the kitchen; restriction of butter to table use, especially for children and adolescents; limitation in the use of lard, bacon and fats; increase in the use of beef drippings and increase in the use of vegetable oils in the preparation of food. Estimated by their food value in the ordinary sense of the term, all these fats are equivalent as food. Variation in use represents mere difference in taste, and it is necessary during the war to curb the taste for butter, lard and bacon and to cultivate the taste for vegetable oils.

One of the particular values of fat in the diet is prolongation of the act of digestion; this has a sociological value because it is of direct influence on the consciousness of alimentation. Cereals consumed without fat are much more rapidly digested than when eaten with fat. A breakfast of 600 calories of bread and jam will be more rapidly digested than a breakfast of 600 calories of bread and butter. Since the sensation of hunger is connected with the termination of the digestion of the previous meal, the individual whose diet is low in fat, even though it is high in calories and protein, will feel under-fed. Now the sensation of under-feeding, the lack of satisfaction, the early return of the appetite after a meal, when it occurs in a population, inevitably leads to unrest. The lack of fats in the German diet is the principal cause for

complaint against the diet. Even when, as in some sections of Germany, the diet was adequate in calories and protein derived from bread, potatoes and other vegetables, but almost devoid of fat, it did not give satisfaction. This lesson must not be overlooked in our cities. It is imperatively necessary that the fat supply of the working classes in the large American cities be maintained. Otherwise, conditions of unrest will inevitably arise, reflecting the physiological fact of the too rapid accomplishment of the act of digestion as a result of deficiency of fat in the diet.

TABLE BEVERAGES

We are entirely dependent upon importation for tea, coffee, cocoa and chocolate. The importance of these table beverages is very slight in the individual sense but it is large in the population viewed as a whole. They contain no nutrients. They do, however, contain substances, like caffeine, that are apparently real stimulants. It is not probable that the majority of people are dependent upon the stimulating action of these alkaloids and that this dependence represents the basis of our desire for such beverages. It is more probable that the beverages owe their place in public esteem to psychological qualities. A beverage at a meal is a practical necessity, all proponents of long mastication

without fluids to the contrary. A warm drink at meals is in particular grateful to the majority of people. These substances have pleasant tastes and aromas. They serve also as a vehicle for the taking of sugar. To a very large number of people a meal will appear incomplete in the absence of one of these beverages. This is particularly true in the working classes. Under these circumstances, deprivation leads to dissatisfaction and unrest. When these articles disappear, the people at once seek substitutes and all manner of leaves, herbs, plants, grains, roots and other substances are brought out to supply a beverage that can be taken warm with the meals, that possesses taste and aroma, and fulfils in a partial sense the psychological contribution of the normal table beverage. Now the persistence with which a people deprived of tea, coffee, cocoa and chocolate seek substitutes indicates the importance of these beverages in the diet and the necessity for maintaining them, certainly with the uneducated classes, if unrest and dissatisfaction are to be avoided.

GARBAGE

Directly connected with the problem of the utilization of food is the question of garbage. In the past the public point of view towards garbage was summed up in the words: "Get it out of the way."

A few years ago cities began to install reduction plants for the recovery of the products of garbage that had an industrial value. A survey of the situation indicates the following recommendations:

(1) In the collection of garbage, inorganic garbage should be separated from organic garbage. In other words, ashes, glass, and street refuse should be separated from garbage of the kitchen and table, and from the very considerable garbage collected from wholesale and retail shops that deal in perishable foodstuffs.

(2) Organic garbage should not be subjected to incineration. It contains two elements of importance that under practically all circumstances can be advantageously used, fat and protein. In large cities regular reduction plants are employed that produce three end-products: fat, a protein-containing fraction that is comparable to tankage, and a residue that is of lesser value. In smaller cities it is often of advantage to extract the fat only, disregarding the other contents. In still smaller cities it does not pay to extract the fat, but it does pay to collect the organic garbage, dry it, sterilize it, pack it into briquettes or powder it. If the collections are made in a proper and cleanly manner and decomposition is not later permitted, the feed value of city garbage is high. The powder containing the dried residue of mixed city garbage,

from which inorganic collections have been excluded, will run high in protein and fat. Such a powder makes an excellent feed for poultry, swine or dairy cattle, depending in part upon the composition.

In cities where regular reduction plants are in operation the fats recovered are used primarily for the manufacture of soap, though it is possible also to use these fats in the feeding of domesticated animals.

The whole subject of the utilization of garbage in the United States is a problem in chemical engineering, and is to be approached and solved only in this way. A campaign of education directed against waste in foodstuffs produces very remarkable reduction in the garbage. During the past four months the garbage of certain cities where an intensive campaign against waste has been conducted has been reduced about 12 per cent, so far as components derived from the kitchen and the table are concerned. The reduction in waste grease has amounted to 29 per cent. Reduction and incineration plants that previously operated day and night, now operate only through a portion of the day. There will always be a certain garbage that cannot be avoided; and for this inevitable garbage, the problem of recovery as an engineering feat remains always and must be solved here, as it has been largely

solved in Germany during the war, if we are to succeed in the conservation of our resources. People must be brought to see that they have the choice to a certain extent between repression in waste and repression in eating; and with this fully understood, repression will be transferred to waste and will show at once in the collection of garbage.

The common American attitude towards garbage as a source of disease is erroneous. Naturally when a community is so slovenly as to dump its ashes, tin cans, broken glass, refuse vegetables, meats, and everything else, including sometimes even its sewage, on the lowlands, to undergo decomposition and drying, to be blown about by the winds, an eye-sore to every one and an offence to the nostrils, people regard the word "garbage" as almost synonymous with "disease." Under these circumstances it is not to be wondered at that the public believes incineration is the correct solution of the problem. Now this is of course entirely unscientific and represents the verdict of prejudice over efficiency. At the time that excess vegetables in retail shops, kitchen waste and table scraps leave the places where they originate, they are hygienically clean. Undergoing simple decomposition does not render them hygienically unclean, except for human consumption. Even considerable degrees of decomposition do not render the material

unfit for animal food if it is later dried and sterilized; but decomposition does represent economic loss always and is therefore to be avoided.

If every community of any appreciable size in the United States installs an equipment for the disposition of its garbage through reduction and utilization, not only would there be enormous savings accomplished in food and feed units but there would be marked improvement in the aesthetic appearances of unoccupied land surrounding American communities. For the smaller cities the problem of profitable recovery is difficult of solution. Up to the present there is no profit in garbage recovery in cities of under 50,000 inhabitants, but this in itself does not justify complete neglect of garbage. It is worth while to dispose of garbage properly even at a loss. We spend a great deal of money for public parks, for the recreation of the people and in a hundred other ways that do not bring a return in money but do bring a return in elevation of the surroundings of life. Certainly the handling of garbage belongs with these other public functions. We do not attempt to make money out of sewage in the American city. The disposition of garbage, where it can not be accomplished with commercial profit, ought to be ranked with the disposition of sewage; and until this point of view is obtained we shall find not only

that garbage represents a large loss in food and feed units but represents also a reflection upon our civic efficiency.

REGIONAL RATIONS

One of the fundamental principles in the food control of a people at war is the avoidance of the use of powers conferred in the exigency to accomplish anything else than the alleviation of nutritional problems arising as a result of the war. A food administration in a country at war must necessarily be endowed with extremely wide powers, powers even including those of repression of consumption of particular articles. The wide powers granted to the food administration in time of war are granted solely for the protection of society against the results of war; they are not intended to be used for the advancement of ideas, no matter how meritorious, whose application in no wise relates to the war-time exigency. In other words, national problems in diet of peace time must not be solved through coercion in war. This is a field for education and not for legislation.

In a small country like Germany or France it is possible to place the entire population upon a fixed ration to be applied to all classes. This is not possible in the United States, nor is it desirable, and for two reasons. In the first place the natural diet

of different sections is widely variant. A traveller transported from the plains of Texas to the hills of New England would regard himself dietetically in a foreign country. The diet and preparation of food in the German and Swedish agricultural classes of the Middle West are entirely different from those of the Mediterranean immigrants in California. While the facilities of modern transportation have made it possible for people of means to select a diet that practically represents the production of the world, nevertheless, the regional influences of production upon the diet of a people is still heavy. Viewed physiologically this state of affairs is both desirable and undesirable; but there can be no question that in the exigency of war time the independence of the population of a certain region represents a factor of importance.

In the present condition of transportation in the United States it would be impossible to ship food about in such a fashion as to give the same diet to people of each of our states. Transportation being such an important factor, it becomes imperative for each State to subsist to as large an extent as possible upon the produce of that State. Certain States, for example, Georgia, had until within a few years pursued so one-sided an agriculture in the production of cotton as to have been a food-importing State in the same sense almost that New

York City was a food-importing city. This may have been efficiency in peace time, since each area produced the crops to which it was most fitted,—although there is a wide difference of opinion upon this point. It is certainly not at all a system of efficiency in war time. This was the basis for the appeal sent out by the President early this year, calling upon the people to produce more largely in foodstuffs in order to render themselves less dependent upon other states.

The tremendous element of trade in connection with the nutrition of a complex people cannot be disregarded in time of war. For example, the flour mills of Kansas City have a regular trade in the country around Buffalo and the Buffalo mills have a regular trade in the country around Kansas City. Now in war time such a state of affairs is absurd. The centralization of the slaughter of meat animals in a few large cities may be efficient in time of peace; but decentralization in the slaughter of domesticated animals, if proper inspection can be maintained, would be unquestionably better in time of war. It is not possible in time of war to alter the normal customs to more than a certain extent; but it is imperative under present conditions of transportation that the people of each State realize fully the importance of this problem, restrict themselves in so far as it may be

possible to the produce of their own State, and so long as the war lasts increase the local production of foodstuffs in order to render themselves independent of importations through the channels of trade.

Of course, this is an injury to the trade, but an injury to trade that is unavoidable in war time and one counterbalanced by gain to the people as a whole. Profit in trade is directly proportional to the multiplicity of transactions. Efficiency in war time is directly proportional to simplicity of transactions. A survey of the regulations and experience of the European countries indicates that with each month as the war life becomes more and more direct, the manipulations of trade become reduced in number and the factors of trade, as contrasted with production and consumption, become more and more relegated to the background.

“Business as usual” is an impossible slogan in war time, since “business as usual” means a multiplicity of trade operations that are not designed to secure the nutrition of the people in the simplest and most direct manner and at the least expense—which is the rôle of a food administration in war time. The same statement holds for the relations of trade in articles of agricultural production. In everything that comes to the farm in the form of fertilizer, seed, and agricultural

implements, and goes from the farm in the form of crops and live stock, the application of the rule, "business as usual," leads to an inefficiency, under the exigency of war time, that has its effect not only on the consumer but also on the producer.

CHAPTER VIII

GRAIN AND ALCOHOL

OUR Allies and the enemy countries have restricted the manufacture of alcoholic beverages. The neutrals surrounding the Central Empires have also restricted the manufacture of alcoholic beverages. The inevitable conclusion is that the manufacture of these beverages represents a waste in grains that must be curtailed in war time. Naturally the same proposition was advanced in our country in the earliest days of the campaign for the restriction of waste. The situations are somewhat different, in that the countries in Europe are grain-importing countries while we are a grain-exporting country. Whenever our people are appealed to for reduction of waste, it is retorted that one waste directly under governmental control lies in the manufacture of alcoholic beverages. To this the reply is made by the trade in alcoholic beverages that the income derived therefrom more than compensates for the amount of grain consumed.

A judicial survey of the problem indicates that there are several factors that must be separated and

clearly evaluated: (1) The loss in grain that attends the manufacture of alcoholic beverages viewed as a total process, a problem in nutrition; (2) the loss of revenue that would attend the enactment of prohibition; (3) the purely ethical motives that formed the basis for the pre-war prohibition movement; (4) the bearing of alcoholism upon national efficiency in war time as a war-time problem; and (5) the relations of alcohol as a narcotic to the stress of an intensive warfare.

For us at this place the nutritional question involved in the manufacture of alcoholic beverages is alone to be considered. There has been a great deal of misapprehension concerning this, as was to have been expected when a peace-time problem has been carried over into war time. On the part of the proponents of prohibition exaggerated statements of the nutritional units concerned in the manufacture of alcoholic beverages have been widely circulated. On the other hand, certain interests concerned with the manufacture of alcoholic beverages have endeavoured to make it appear that a gain in nutritional units is accomplished through the fermentation of grain. The data are available to every one and the interpretation clear. Three sentences suffice to summarize the scientific conclusions:

(1) The grains employed in the manufacture of alcoholic beverages are predominately feed grains

and not bread grains, and the total amount employed represents on an average not much over 2 per cent of the total grain production;

(2) If the grains devoted to the manufacture of alcoholic beverages be devoted to the feeding of domesticated animals, there will be little gain as compared to the results when the same grains are used in the manufacture of alcoholic beverages and the spent residues devoted to the feeding of live stock;

(3) There would be a large gain if the grains devoted to the manufacture of alcoholic beverages should be devoted directly to the feeding of human beings.

The following paragraphs will make these relations clear. During the fiscal year ending June 30, 1916, the materials required for the manufacture of distilled spirits were in round figures as follows, in bushels: Malt, 4 million; corn, 32 million; rye, 3 million; oats, wheat and other cereals up to a total of 39,500,000 bushels. This grain is all supposed to be grain of good quality but it is not necessarily grain of millable quality. All of these grains are of course of quality fit for the feeding of domesticated animals. In addition, molasses was used to the extent of over 152,000,000 gallons. The money value of these ingredients was somewhere in the neighbourhood of \$44,000,000.

The money value of the distillers' spent grains was somewhere in the neighbourhood of \$9,000,000. These figures represent a large increase over the figures of the previous year, but this increase was due principally to an augmented demand for alcohol used in war industries.

An analysis of the data indicates that of the total production, 249,000,000 gallons, of distilled spirits in 1916, some 123,000,000 gallons were manufactured for purposes of human consumption, leaving 126,000,000 gallons that were devoted to technical use in industry, arts and the sciences. With the continuation of the war it is clear that our production of industrial alcohol must be progressively augmented. We are unable to hope that in the immediate future there will be any reduction in the utilization of grains for the manufacture of industrial spirits. The whisky now in bond could be redistilled—over 200,000,000 gallons were in the bonded warehouses in June, 1917. The molasses used in the manufacture of distilled spirits was in the past always molasses of feeding grade and not of the quality employed as human food. During the past year, however, owing to conditions in the manufacture of sugar, a great deal of molasses entirely fit for human consumption was used in distilleries.

We face the necessity of securing non-edible ma-

terials from which alcohol may be prepared. Many substances are available to a greater or less extent in different portions of the country, were the methods of utilization developed as they have been abroad. Sweet and white potatoes, kafircorn and sorghum grains ought to be included. In Germany the manufacture of alcohol from potato has been successfully practised for a long time and the excess sweet and white potatoes of this country would yield a large amount of alcohol. Sugar beet pulp, now utilized as a stock feed, also yields alcohol under appropriate processing, and the same is true of the residues of the sugar cane. The sulphite liquors of pulp mills, straw and sawdust can all be employed for the manufacture of alcohol and are indeed so employed in this country on a small scale. Garbage represents a source of carbohydrate from which alcohol may be produced. Unfortunately the development of processes for the manufacture of alcohol from other substances than grain and molasses is in its very beginning in this country, and it does not seem possible to hope for great expansion in these directions in the immediate future. Under these circumstances, we fear that during the next year more grain will be employed in the manufacture of alcohol for industrial purposes than was last year employed in the manufacture of distilled spirits for beverages and industrial

purposes combined. If the manufacture of alcohol be permitted to such distilleries only as are equipped to dry and market the spent grains the losses will be minimal.

Corn is our heaviest crop and corn is the grain most used in the manufacture of whisky. If this corn were used in feeding live stock what would be the gain over the use of corn employed in the manufacture of whisky? It is impossible to answer the question by a single statement or figure on account of a necessary difficulty in the selection of a criterion. One must either judge from the standpoint of total energy values or from the standpoint of the gain in a single all-important constituent, protein. Decision from the standpoint of protein is easy; from the standpoint of total energy, difficult, or, indeed, impossible.

The use of protein as a criterion in deciding the question is made all the more advantageous by the fact that in the feeding of live stock in this country protein is a much more important factor than carbohydrate or pure energy-producing material. Now when corn is converted into whisky all of the protein remains in the distillers' grains. If these were all recovered, dried and used as a stock feed, they would contain all of the original protein value of the grain. There are well-grounded objections to the use of distillers' slops and moist distillers'

grains for feeding; but when distillers' grains are dried and heated these objections disappear, so that used as a concentrate in connection with other feeds, dried distillers' grains form a first-grade feeding-stuff.

The real question then becomes: What proportion of distillers' grains are employed as stock feed? It is impossible to obtain accurate figures. With the ascending price of cattle feed, the distillers can afford to recover their spent grains more carefully, and prepare them for the market by drying. As a matter of fact they are becoming more and more widely used as ingredients of mixed stock feeds. Unquestionably there is still loss in connection with small distilleries lying in more or less out of the way localities. Nevertheless, viewing the matter as a whole, it is clear that in the conversion of corn into whisky, there need be little loss of nutrient units from the standpoint of conservation. If the particular corn used in the manufacture of whisky were used instead as human food there would be a large gain, as will be later shown; but when one realizes that the consumption of corn as human food in this country is less than 10 per cent of the available crop, even this statement of the argument is somewhat forced.

During the fiscal year ending June 30, 1916, barley to the extent of over 52,000,000 bushels was

converted into malt for use in the manufacture of beer, including in this term all brewed beverages. In addition to this some 13,000,000 bushels of corn, including grits and cerealine, and 2,500,000 bushels of rice were also employed. The amount of sugar used is not recorded. This does not represent the total amount of barley converted into malt. There was a relatively heavy export and malt is also employed to a considerable extent by bakers and in various technical industries.

Now this amount represents from a third to a fourth of the whole of the ordinary crop of barley in our country. Barley in the United States is largely a feed grain, the manufacture of barley flour being practically unknown before the war. A certain amount of pearl barley and barley preparations were used in the diet of children and of the sick, and barley breakfast foods have also appeared upon the market. But barley in the distant past was regarded as a bread grain. In the pre-war period barley was used for bread in Russia, Sweden and Norway, and to some extent in Germany, where it was also widely consumed in the state of pearl barley. There is a common notion with American stockmen that barley has a low nutritive value as a feed for domesticated animals. This is entirely untrue. Barley, largely used either as barley offal or as the crushed grain, is an excellent

concentrated feeding-stuff, and, in Denmark and Germany, where the feeding of domesticated animals has been much more specialized than in this country, barley is a favourite feeding grain, particularly for swine.

The rice used in the manufacture of beer is in large part not such rice as could be sold for table rice, consisting more of broken rice, screenings and uneven grades that, perfectly good in themselves, are excluded by the standards of the market. Grits and cerealine also, while perfectly good products, are not high grade in market classification. If these grains were not employed in the manufacture of beer they would probably be used as feed for domesticated animals or poultry. If the barley employed in the manufacture of beer were used for animal feed directly there would be little gain in the exchange. About 15 per cent of the protein of the barley re-appears in the beer. A certain percentage, let us say, 10 per cent, is contained in the yeast. A certain percentage is in the sprouts and the remainder in the brewers' grains.

The sprouts are used largely in the manufacture of yeast for bread-making and also in other technical industries, though employed to some extent as a high-grade stock feed. The yeast ought to be entirely saved and used as stock feed, and in the best breweries it is not wasted. In many smaller brew-

eries, however, there is a large waste in yeast. The dried brewers' grains proceeding from a unit of malt after the manufacture of beer is completed contain the largest fraction of the protein of the original barley. In view of the present price of feed it must be assumed that there is little wastage in spent grains and sprouts. Assuming that this wastage is as much as 10 per cent, it is apparent that domesticated animals receive at present about two-thirds of the protein contained in the original barley and that of the remainder the largest fraction goes into human food in the form of beer and in bread. Obviously there is, from the nutritional point of view, little loss when barley is employed in the manufacture of beer and the residues fed to domesticated animals contrasted with the results of direct feeding of the barley to animals.

A very different result however is obtained when the barley is used as human food. Transfer of barley from the brewery to the flour mill involves a gain in nutritive units for human consumption and a loss for domesticated animals. The gain and loss are not directly comparable, but the relations may be made clear. In accordance with the experience of European countries during this war, barley flour represents one of the best flours for admixture with wheat flour in the production of mixed flour bread. The best results are obtained, with

the lowest alteration in the bread-making qualities of the mixture, and with the least detectable change in taste of the bread and retention of the keeping qualities of the flour, when the barley is milled to not more than a 60 per cent extraction. If the barley were so milled, and the flour were employed as human food and the offal used as stock feed, about one-third of the protein would be in the grain offal and two-thirds in the flour. If the grain offal were fed under standard conditions to dairy cattle, the protein would be recovered to an extent of about 30 to 35 per cent; if fed to pork the protein would be recovered to an extent of about 25 per cent under favourable conditions. These same coefficients must be applied to the barley when used in the manufacture of beer and the residues used as stock feed.

On the one side of the comparison, then, we have the food units in the barley flour plus the food units obtained in milk, pork or beef as the result of feeding of the barley offal. On the other side of the comparison is the food unit in the beer plus the food units obtained in milk, pork and beef as the result of feeding the brewers' grains, sprouts, and yeast. The recoveries are in each instance highest in the case of milk and lowest in the case of beef. When the protein values of 50,000,000 bushels of barley are thus calculated, on the basis of standard feeding values and assuming that the grains are em-

ployed to the same extent both in the feeding of cattle and of swine, the gain in protein as human food-stuff when the barley is used in the manufacture of flour instead of in the manufacture of beer would amount to somewhere between 80,000,000 and 100,000,000 pounds of protein. This amount of protein is sufficient to meet the annual protein requirements of about 2,500,000 people. Exported to France and expressed in terms of bread, the American barley used in the manufacture of beer last year was equal to the normal bread ration of 7,000,000 people. This figure becomes more impressive when we recall that the beer here cannot be applied to a per capita ration.

The gain, however, in another sense would be still larger. What our Allies need is flour, and the flour of barley is entirely acceptable to them and can be mixed with wheat flour in the proportion of four to one. The loss in feed protein involved in the use of this barley as food is so small in contrast to our production of corn, oats, beans, cowpeas, cottonseed cake, linseed cake, and velvet beans as to fall outside of all consideration in the quantitative sense. Calculated in terms of milk, the protein value of brewers' grains is worth about 150,000,000 gallons of milk per annum. This, while a large figure, does not loom large against some 8,000,000,000 gallons of milk that are supposed to

be produced annually in this country. On the other hand, brewers' grains are not used evenly throughout the country in a geographical sense, but are used to a large extent in certain zones. In Wisconsin and Illinois and in the eastern dairy territory, the loss of dried brewers' grains would embarrass the feeding operations unless other proteins were made available. Such proteins, however can be made freely available; their utilization is merely a question of organization on the part of national and state departments of agriculture.

From all this it can be seen that there is not much occasion for discussion of grain and alcohol from the food-saving point of view, unless the people are prepared either to consume the barley flour themselves or to export this barley flour to our Allies. Merely to cease the manufacture of beer without provision for the utilization of the barley flour would accomplish almost nothing. The barley would simply remain as a slight addition to the stock of feed grains and little conservation would have been accomplished. If, however, the barley were milled, the flour would represent a very material addition of human food, an addition much needed because of the present low stock and short crop of wheat.

CONCLUSION

PATRIOTISM AND FOOD

PATRIOTISM and food! Winning a world war by eating corn and chicken instead of wheat and beef! It will take much education to get this point of view. An army of food-savers does not appeal to the imagination at first consideration. But remember the large words of M. Bloch: "That is the future of war—not fighting but famine."

Germany is fighting not only with armies of men in field-grey but with greater armies of un-uniformed men, women and children; the civilian armies of workers and food-savers. Germany is fighting as a whole people, a whole nation mobilized. Germany is fighting to win a war that was to have been all conquest and glory, and is now all *Durchhalten*. In this fighting and *Durchhalten* Germany has lifted food to all the importance that M. Bloch prophesied for it. She is struggling to hold off famine from herself and to assure famine for her enemies. Germany controls food, saves food, stretches food, as no nation ever did before. That she has not already been beaten is due no less to her

food organization than to her fighting organization. She has put patriotism and food together. So must we.

It is a time of rare and glorious opportunity; a time in which prosaic business and industry may be lifted up to the high plane of national service. And it is being so conceived in many quarters. The editor of a millers' journal puts it well for his miller and baker readers when he says: "He who grinds a barrel of flour or makes a loaf of bread to the glory and the good of the nation, forgetful of self, performs his duty in a spirit of devotion equal in its way to that of him who goes forth to actual battle."

And just as business and industry can perform their national service by putting patriotism and food together, so can we who serve our households and public dining-rooms; and so also can we who eat—in a word, all of us. There is no magic way to making food win the war. It can be done but in one way, the way of voluntary and eager resolution and action of the whole people, each group and each person according to the measure of his opportunity and means; a matter of daily personal service on every farm, in all the places through which pass the great food masses, and, finally, in every little shop and every kitchen and at every table in the land.

It is not a sordid association, patriotism and food. It can be as fine as the spirit of democracy and as ennobling as the struggle for democracy. For it is, in truth, in these days an essential part of each. If we cannot organize our effort in this world crisis by the individual initiative, spirit and consent of the people, then democracy is a faith on which we cannot stand. For autocracy has shown that it can organize its effort; it does it by imposing organization by force, from the top. We must do it from the bottom, and voluntarily. The administration of food is a test of what our form of government is worth. If success in it did no more than insure its immediate aim, providing our Allies with food, it would be wholly worth while. But it will do more than that; it will prove our faith in ourselves.

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